6 Anexos.

6.1 Código para "ganancia2.mdl".

6.1.1 Informe de la Generación de Código para *"ganancia2.mdl"*.

- Code Generation Report for ganancia2
  - Summary

    Real-Time Workshop code generated for Simulink model "ganancia2.mdl".

    - Model Version : 1.6
    - Real-Time Workshop file version : 5.0 $Date: 2002/05/30 19:21:33 $
    - Real-Time Workshop file generated on : Wed Aug 13 12:45:38 2003
    - TLC version : 5.0 (Jun 18 2002)
    - C source code generated on : Wed Aug 13 12:45:40 2003

    Relevant TLC Options

    - Roll Threshold : 5
    - Code Format : Embedded-C

    Simulink model settings

    - Solver : Fixed Step
    - Fixed Step : 0.02 s
- Optimisations

The following table lists selected code generation options. Options prefixed with an ellipsis (...) depend on a main configuration option. Settings which result in less efficient code are marked in *italic*.

Optimisation Types	Value [On/Off]	Optimisation Types	Value [On/Off]
Block reduction	on	Single output/update function	on
Boolean logic signals	on	MAT-file logging	off
Parameter pooling	on	Inline invariant signals	*off*
Inline Parameters	*off*	Initialise internal data	*on*
Signal storage reuse . . .buffer reuse . . .Local block outputs	on on on	Initialise external I/O data	*on*
Expression folding . . . Fold Unrolled vectors	on on	Conditional input branch	on

- Enforce integer downcast

The code generation option “Enforce integer downcast” refers to 8-bit operations on 16-bit microprocessors, and 8 and 16-bit operations on 32-bit microprocessors. To insure consistency between simulation and code generation, the results of expressions involving 8 and 16-bit integer signals must be explicitly downcasted. Deselecting this option improves code efficiency. The primary effect of deselecting this option is that expressions involving 8 and 16-bit arithmetic are less likely to overflow in code than they are in simulation. We recommend that you turn this option on for safety. Turn the option off only if you are concerned with generating the smallest possible code, and you know that 8 and 16-bit signals will not overflow. Currently, the option is off in this model.

- Static code dependencies

The generated code depends on these header files.

Relative path from the MATLAB root directory

- extern/include/tmwtypes.h
- simulink/include/simstruc_types.h
- rtw/c/libsrc/rtlibsrc.h

The generated code depends on the external functions located in ($MATLAB_ROOT)/rtw/c/libsrc.

- Data initialisation

Non-zero, non-static data is always initialised. Initialising data to zero may be redundant for your application. Initialisation code is optionally generated with the Initialise internal data and Initialise external I/O data options.

- Additional information
  - Use of Data Types
  - Interfacing Signals to External Code
  - Preserving function names and boundaries

6.1.2 Códigos Fuente y Librerías generadas para “ganancia2.mdl”.

Todos los archivos se hallan dentro de la ruta de directorio siguiente: *“d:\Matlab\work\ganancia2_ert_rtw”*.

6.1.2.1 Código Fuente de *"ert_main.c"*.

```
/*
 * Auto generated example main program for model: ganancia2
 *
 * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
 * Real-Time Workshop file generated on : Wed Aug 13 12:45:38 2003
 * C source code generated on           : Wed Aug 13 12:45:40 2003
 *
 * Description:
 *   Real-Time Workshop Embedded Coder example single rate main assuming
 *   no operating system.
 *
 * For more information:
 *   o Real-Time Workshop User's Guide
 *   o Real-Time Workshop Embedded Coder User's Guide
 *   o matlabroot/rtw/c/ert/ert_main.c
 *   o Type 'ecodertutorial' in MATLAB
 *
 * For a real-time operating system deployment example, reconfigure the
 * "Target operating system" option to "VxWorksExample".
 */

#include <stdio.h>                  /* This ert_main.c example uses printf/fflush */
#include "tmwtypes.h"                  /* MathWorks types */
#include "simstruc_types.h"            /* Simulink types */
#include "ganancia2.h"                 /* Model's header file */

static boolean_T OverrunFlag = 0;

/* Associating rt_OneStep with a real-time clock or interrupt service routine
 * is what makes the generated code "real-time".  The function rt_OneStep is
 * always associated with the base rate of the model.  Subrates are managed
 * by the base rate from inside the generated code.  Enabling/disabling
 * interrupts and floating point context switches are target specific.  This
 * example code indicates where these should take place relative to executing
 * the generated code step function.  Overrun behavior should be tailored to
 * your application needs.  This example simply sets an error status in the
 * real-time model and returns from rt_OneStep.
 */
void rt_OneStep(void)
{
  /* Disable interrupts here */

  /* Check for overrun */
  if (OverrunFlag++) {
    rtmSetErrorStatus(ganancia2_M, "Overrun");
    return;
  }

  /* Save FPU context here (if necessary) */
  /* Re-enable timer or interrupt here */
  /* Set model inputs here */

  ganancia2_step();

  /* Get model outputs here */

  OverrunFlag--;

  /* Disable interrupts here */
  /* Restore FPU context here (if necessary) */
  /* Enable interrupts here */
}

/* The example "main" function illustrates what is required by your
 * application code to initialize, execute, and terminate the generated code.
 * Attaching rt_OneStep to a real-time clock is target specific.  This example
 * illustrates how you do this relative to initializing the model.
 */
int_T main(int_T argc, const char_T *argv[])
{

  printf("Warning: The simulation will run forever. "
    "To change this behavior select the 'MAT-file logging' option.\n");
  fflush(NULL);
```

```
 /* Initialize model */
 ganancia2_initialize(1);

 /* Attach rt_OneStep to a timer or interrupt service routine with
  * period 0.02 seconds (the model's base sample time) here.  The
  * call syntax for rt_OneStep is
  *
  * rt_OneStep();
  */

 while (rtmGetErrorStatus(ganancia2_M) == NULL) {
   /* Perform other application tasks here */
 }

 /* Disable rt_OneStep() here */

 /* Terminate model */
 ganancia2_terminate();
 return 0;
}
```

6.1.2.2 Código Fuente de *"ganancia2.c"*.

```
/*
 * Real-Time Workshop code generation for Simulink model "ganancia2.mdl".
 *
 * Model Version                        : 1.6
 * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
 * Real-Time Workshop file generated on : Wed Aug 13 12:45:38 2003
 * TLC version                          : 5.0 (Jun 18 2002)
 * C source code generated on           : Wed Aug 13 12:45:40 2003
 */

#include "ganancia2.h"
#include "ganancia2_private.h"

/* Block states (auto storage) */
D_Work_ganancia2 ganancia2_DWork;

/* Real-time model */
RT_MODEL_ganancia2 ganancia2_M_;
RT_MODEL_ganancia2 *ganancia2_M = &ganancia2_M_;

/* Model step function */
void ganancia2_step(void)
{
  /* local block i/o variables */
  real_T rtb_temp0;

  /* Sin: '<Root>/Sine Wave' */
  /* Sample Based Sine Wave Output Function */

  rtb_temp0 = ganancia2_P.Sine_Wave_Amp
    * sin( 2.0 * RT_PI*( ganancia2_DWork.Sine_Wave_IWORK.Counter +
    ganancia2_P.Sine_Wave_Offset)/ ganancia2_P.Sine_Wave_NumSamp )
    + ganancia2_P.Sine_Wave_Bias;

  /* Gain: '<Root>/Gain'
   *
   * Regarding '<Root>/Gain':
   *   Gain value: ganancia2_P.Gain_Gain
   */
  rtb_temp0 *= ganancia2_P.Gain_Gain;

  /* Sin Block: <Root>/Sine Wave */
  ganancia2_DWork.Sine_Wave_IWORK.Counter =
    ganancia2_DWork.Sine_Wave_IWORK.Counter + 1;
  if ((ganancia2_DWork.Sine_Wave_IWORK.Counter) ==
   (ganancia2_P.Sine_Wave_NumSamp)) {
    ganancia2_DWork.Sine_Wave_IWORK.Counter = 0;
  }
}

/* Model initialize function */
```

```
void ganancia2_initialize(boolean_T firstTime)
{
 if (firstTime) {
   /* registration code */
   rtmSetErrorStatus(ganancia2_M, (const char_T *)0);

   /* data type work */
   (void)memset((char_T *) &ganancia2_DWork, 0, sizeof(D_Work_ganancia2));
 }
}

/* Model terminate function */
void ganancia2_terminate(void)
{
 /* (no terminate code required) */
}
```

6.1.2.3 Código Fuente de *"ganancia2_data.c"*.

```
/*
 * ganancia2_data.c
 *
 * Real-Time Workshop code generation for Simulink model "ganancia2.mdl".
 *
 * Model Version                  : 1.6
 * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
 * Real-Time Workshop file generated on : Wed Aug 13 12:45:38 2003
 * TLC version                    : 5.0 (Jun 18 2002)
 * C source code generated on           : Wed Aug 13 12:45:40 2003
 */

#include "ganancia2.h"
#include "ganancia2_private.h"

/* Block parameters (auto storage) */
const Parameters_ganancia2 ganancia2_P = {
  1.0 ,                        /* Sine_Wave_Amp : '<Root>/Sine Wave' */
  0.0 ,                        /* Sine_Wave_Bias : '<Root>/Sine Wave' */
  100.0 ,                       /* Sine_Wave_NumSamp : '<Root>/Sine Wave' */
  0.0 ,                        /* Sine_Wave_Offset : '<Root>/Sine Wave' */
  2.0                          /* Gain_Gain : '<Root>/Gain' */
};
```

6.1.2.4 Código Fuente de *"ganancia2.h"*

```
/*
 * ganancia2.h
 *
 * Real-Time Workshop code generation for Simulink model "ganancia2.mdl".
 *
 * Model Version                  : 1.6
 * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
 * Real-Time Workshop file generated on : Wed Aug 13 12:45:38 2003
 * TLC version                    : 5.0 (Jun 18 2002)
 * C source code generated on           : Wed Aug 13 12:45:40 2003
 */

#ifndef _RTW_HEADER_ganancia2_h_
# define _RTW_HEADER_ganancia2_h_

#ifndef _ganancia2_COMMON_INCLUDES_
# define _ganancia2_COMMON_INCLUDES_
#include <math.h>
#include <float.h>
#include <string.h>

#include "tmwtypes.h"
#include "simstruc_types.h"
#include "rtlibsrc.h"

#endif                         /* _ganancia2_COMMON_INCLUDES_ */

#include "ganancia2_types.h"
```

```
/* Intrinsic types */
#ifndef POINTER_T
# define POINTER_T
typedef void * pointer_T;
#endif

/* Block states (auto storage) for system: '<Root>' */
typedef struct D_Work_ganancia2_tag {
  struct {
    void *LoggedData;
  } Scope_PWORK;                       /* '<Root>/Scope' */
  struct {
    int_T Counter;
  } Sine_Wave_IWORK;                   /* '<Root>/Sine Wave' */
} D_Work_ganancia2;

/* Parameters (auto storage) */
struct _Parameters_ganancia2 {
  real_T Sine_Wave_Amp;                /* Expression: 1
                                        * '<Root>/Sine Wave'
                                        */
  real_T Sine_Wave_Bias;               /* Expression: 0
                                        * '<Root>/Sine Wave'
                                        */
  real_T Sine_Wave_NumSamp;            /* Expression: 100
                                        * '<Root>/Sine Wave'
                                        */
  real_T Sine_Wave_Offset;             /* Expression: 0
                                        * '<Root>/Sine Wave'
                                        */
  real_T Gain_Gain;                    /* Expression: 2
                                        * '<Root>/Gain'
                                        */
};

/* Real-time Model Data Structure */
struct _RT_MODEL_ganancia2_Tag {
  const char *errorStatus;
};

/* Real-time Model object */
extern RT_MODEL_ganancia2 *ganancia2_M;

/* Macros for accessing real-time model data structure  */

#ifndef rtmGetErrorStatus
# define rtmGetErrorStatus(rtm) (rtm)->errorStatus
#endif

#ifndef rtmSetErrorStatus
# define rtmSetErrorStatus(rtm, val) (rtm)->errorStatus = ((val))
#endif

#ifndef rtmGetTStart
# define rtmGetTStart(rtm) (0.0)
#endif

/* Backward compatibility for real-time model name change */
#define ganancia2_rtO                  ganancia2_M
#define ganancia2_RT_OBJECT            RT_MODEL_ganancia2

/* Block parameters (auto storage) */
extern const Parameters_ganancia2 ganancia2_P;

/* Block states (auto storage) */
extern D_Work_ganancia2 ganancia2_DWork;

/* Model entry point functions */
extern void ganancia2_initialize(boolean_T firstTime);
extern void ganancia2_step(void);
extern void ganancia2_terminate(void);

/*
 * The generated code includes comments that allow you to trace directly
 * back to the appropriate location in the model.  The basic format
 * is <system>/block_name, where system is the system number (uniquely
```

```
 * assigned by Simulink) and block_name is the name of the block.
 *
 * Use the MATLAB hilite_system command to trace the generated code back
 * to the model.  For example,
 *
 * hilite_system('<S3>')    - opens system 3
 * hilite_system('<S3>/Kp') - opens and selects block Kp which resides in S3
 *
 * Here is the system hierarchy for this model
 *
 * '<Root>' : ganancia2
 */

#endif                                 /* _RTW_HEADER_ganancia2_h_ */
```

6.1.2.5 Código Fuente de *"ganancia2_private.h"*.

```
/*
 * ganancia2_private.h
 *
 * Real-Time Workshop code generation for Simulink model "ganancia2.mdl".
 *
 * Model Version                        : 1.6
 * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
 * Real-Time Workshop file generated on : Wed Aug 13 12:45:38 2003
 * TLC version                          : 5.0 (Jun 18 2002)
 * C source code generated on           : Wed Aug 13 12:45:40 2003
 */

#ifndef _RTW_HEADER_ganancia2_private_h_
# define _RTW_HEADER_ganancia2_private_h_

/* Private Macros used by the generated code to access rtModel */

#ifndef rtmIsMajorTimeStep
# define rtmIsMajorTimeStep(rtm) (1)
#endif

#ifndef rtmIsMinorTimeStep
# define rtmIsMinorTimeStep(rtm) (0)
#endif

#ifndef _RTW_COMMON_DEFINES_
# define _RTW_COMMON_DEFINES_

#ifndef TRUE
# define TRUE (1)
#endif
#ifndef FALSE
# define FALSE (0)
#endif
#endif                                 /* _RTW_COMMON_DEFINES_ */

#ifndef UCHAR_MAX
#include <limits.h>
#endif

#if ( UCHAR_MAX != (0xFFU) )
#error Fixed point code was generated for compiler with different sized uchars.
#endif

#if ( SCHAR_MAX != (0x7F) )
#error Fixed point code was generated for compiler with different sized chars.
#endif

#if ( USHRT_MAX != (0xFFFFU) )
#error Fixed point code was generated for compiler with different sized ushorts.
#endif

#if ( SHRT_MAX != (0x7FFF) )
#error Fixed point code was generated for compiler with different sized shorts.
#endif

#if ( UINT_MAX != (0xFFFFFFFFU) )
#error Fixed point code was generated for compiler with different sized uints.
```

```
#endif

#if ( INT_MAX != (0x7FFFFFF) )
#error Fixed point code was generated for compiler with different sized ints.
#endif

#if ( ULONG_MAX != (0xFFFFFFFFU) )
#error Fixed point code was generated for compiler with different sized ulongs.
#endif

#if ( LONG_MAX != (0x7FFFFFF) )
#error Fixed point code was generated for compiler with different sized longs.
#endif

#endif                          /* _RTW_HEADER_ganancia2_private_h_ */
```

6.1.2.6 Código Fuente de *"ganancia2_types.h"*.

```
/*
 * ganancia2_types.h
 *
 * Real-Time Workshop code generation for Simulink model "ganancia2.mdl".
 *
 * Model Version                        : 1.6
 * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
 * Real-Time Workshop file generated on : Wed Aug 13 12:45:38 2003
 * TLC version                          : 5.0 (Jun 18 2002)
 * C source code generated on           : Wed Aug 13 12:45:40 2003
 */

#ifndef _RTW_HEADER_ganancia2_types_h_
# define _RTW_HEADER_ganancia2_types_h_

/* Parameters (auto storage) */
typedef struct _Parameters_ganancia2 Parameters_ganancia2;

/* Forward declaration for rtModel */
typedef struct _RT_MODEL_ganancia2_Tag RT_MODEL_ganancia2;

#endif                          /* _RTW_HEADER_ganancia2_types_h_ */
```

6.2 Ecuaciones de Estado: Transformación a Tiempo Discreto.

[B39] En este anexo se pretende presentar, formalmente, la transformación de las ecuaciones de estado de un sistema dinámico en tiempo continuo a sus homólogas en tiempo discreto; de forma que, finalmente, se obtenga una relaciones de identidad entre las matrices de ambas ecuaciones de estado.

Dadas las ecuaciones de estado en tiempo continuo:

$$x'(t) = Ax(t) + Bu(t); \quad [1a]$$
$$y(t) = Cx(t) + Du(t); \quad [1b]$$

En donde la *coma* denota derivación respecto de la variable independiente *'t'*. Definiéndose:

$$x \in \Re^n; y \in \Re^p; u \in \Re^m;$$
$$A \in \Re^{n \times n}; B \in \Re^{n \times m}; C \in \Re^{p \times n}; D \in \Re^{p \times m};$$

La ecuación [1a] se denomina ecuación de estado, mientras que la [1b] recibe el nombre de ecuación de salida. Esta denominación mantiene la coherencia con la relacionada con las variables, es decir, a *'x(t)'* se la llama variable de estado y a *'y(t),'* de salida.

La solución al sistema homogéneo asociado a la ecuación [1a], tras la extensión desde el sistema de una única dimensión (*n, p, m = 1*), presenta la forma:

$$x(t) = e^{A \cdot (t - t_0)} \cdot x(t_0); \quad [2]$$

En donde:

- El estado en el instante inicial *'t_0'*: $x(t_0)$;
- La matriz de transición entre el estado en *'t_0'* y el estado evaluado en *'t'*: e^{At}; $t = t - t_0$;

La definición de esta matriz se basa en un abuso de notación que sustituye, por similitud con el desarrollo para una dimensión, a lo siguiente:

$$e^{A \cdot \tau} = \sum_{k=0}^{\infty} \frac{(A \cdot \tau)^k}{k!}; \quad (A \cdot \tau)^0 \equiv I_n; \quad [3]$$

Obtengamos una expresión para los coeficientes del sumatorio. Para ello aplicaremos el siguiente proceder que se culminará con un ejemplo ilustrativo.

De acuerdo con el teorema de *Cayley – Hamilton*, toda matriz $A \in \Re^{nxn}$ satisface su ecuación característica $Q(l)$[1], la cual se construye a partir de los *autovalores*[2] $l_k \in C$ de A de esta forma:

$$\lambda \cdot x = A \times x; \quad \Rightarrow \quad \det\left[\lambda \times I_n - A\right] = 0; \quad \Rightarrow \quad Q(\lambda) = \prod_{m=1}^{n}(\lambda - \lambda_m) = \sum_{k=0}^{k=n} a_k \cdot \lambda^k; \; a_n \equiv 1; \quad [4]$$

Construyamos el siguiente polinomio matriz extensión del polinomio algebraico en l_k, el cual es analítico[3]:

$$P(A) = A^n + C_{n-1} \times A^{n-1} + \cdots + C_1 \times A + C_0 \times I; \quad [5]$$

Siendo la ecuación característica de A: $Q(A)$;

Podemos escribir el cociente polinómico, válida para cualquier orden siempre que sea analítica: $P(A) / Q(A) = F(A) + R(A) / Q(A)$; siendo $F(A)$ el cociente y $R(A)$ el resto; o bien de la forma:

$$\left.\begin{array}{c} P(A) = F(A) \cdot Q(A) + R(A); \\ Q(A) = 0; \end{array}\right\} \quad \Rightarrow \quad F(A) = R(A); \quad [6]$$

Concretando para $P(A) = e^{lt}$, analítico, también se validará la ecuación; además, $P(A)$ permite la expresión como serie de potencias que, gracias a su grado de convergencia, puede ser aproximada por un número finito de términos, sea $n - 1$.

Así pues, concretando para cada autovalor l_k de A, se tiene, partiendo del polinomio del resto:

$$P(\lambda_k) = R(\lambda_k) = \sum_{m=0}^{m=n-1} r_m(t)(\lambda_k)^m; \quad [7]$$

Aunando este resultado para el conjunto total de n ecuaciones, se obtiene:

$$e^{A \cdot t} = P(A) = R(A) = \sum_{m=1}^{m=n-1} r_m(t) \cdot A^m; \; A^0 \equiv I_n; \quad [8]$$

- Ejemplo: calculemos la matriz de transición de estados e^{At} siendo la matriz A que, en este caso, es de segundo orden:

$$A = \begin{bmatrix} 0 & -5 \\ -1 & -4 \end{bmatrix}; \quad [9a]$$

[1] $Q(A) = 0$;
[2] cuya denominación más extendida, de etimología alemana, es: *"eigenvalue"*.
[3] analítico implica que permite ser derivado infinitas veces.

- Recordando la expresión de su ecuación característica $Q(l) = |lI - A| = 0$, se tiene:

$$Q(\lambda) = \left| \lambda \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} - \begin{bmatrix} 0 & -5 \\ -1 & -4 \end{bmatrix} \right| = \lambda^2 + 4\lambda - 5 = 0; \quad [9b]$$

Cuyas soluciones, autovalores de A, son: $l_1 = 1$; $l_2 = -5$; e introduciéndolos en la ecuación polinómica del resto [7] con $n = 2$: $R(l) = r_0(t) + r_1(t)\, l$; que, concretando $l = l_1, l_2$, se expresa como:

$$\left.\begin{aligned} e^{1t} &= r_0(t) + r_1(t) \cdot 1; \\ e^{-5t} &= r_0(t) + r_1(t) \cdot (-5); \end{aligned}\right\} \Rightarrow \begin{cases} r_0(t) = \dfrac{1}{6} \cdot \left(6e^{t} + e^{-5t}\right); \\ r_1(t) = \dfrac{1}{6} \cdot \left(e^{t} - e^{-5t}\right); \end{cases} \quad [9c]$$

De acuerdo con la expresión [8], la matriz de transición de estados vendrán dada por:

$$e^{A \cdot t} \equiv r_0(t) \cdot I_2 + r_1(t) \cdot A = \frac{1}{6} \cdot \begin{bmatrix} 5e^{t} + e^{-5t} & -5 \cdot \left(e^{t} - e^{-5t}\right) \\ -\left(e^{t} - e^{-5t}\right) & e^{t} + 5e^{-5t} \end{bmatrix}; \quad [10]$$

Existen otros métodos para obtener esta matriz, resultando ser muy apropiado para su ejecución en un computadora digital el que se basa en la expansión de *Sylvester*, el cual presentaremos brevemente:

$$e^{A \cdot t} \equiv N(A) = \sum_{k=1}^{n} N(\lambda_k) \cdot Z_k(\lambda); \quad Z_k(\lambda) = \frac{\sum_{k=1;\, j \neq k}^{n} \left(A - \lambda_j \cdot I_n\right)}{\sum_{k=1;\, j \neq k}^{n} \left(\lambda_k - \lambda_j\right)}; \quad [11]$$

Suponemos que A, matriz cuadrada de orden n, posee h < n autovalores diferentes; siendo $Z_k(l)$ las matrices constituyentes de A.

Entonces la matriz de transición de estados, para nuestro ejemplo, será:

$$e^{A \cdot t} = e^{\lambda_1 \cdot t} \cdot Z_1(\lambda_1) + e^{\lambda_2 \cdot t} \cdot Z_2(\lambda_2); \quad [12]$$

Por otro lado, si integramos la ecuación de estado [1a] desde 't_0' a 't' y multiplicamos el resultado por la matriz de transición de estados entonces obtenemos:

$$x'(t) = Ax(t) + Bu(t); \quad \Rightarrow \quad x(t) = e^{A(t - t_0)} \cdot x(t_0) + \int_{t_0}^{t} e^{A(t-\tau)} Bu(\tau) \cdot d\tau; \quad t < t_0; \quad [13]$$

Concretando esta ecuación para los instantes: $t = (k + 1)\ T$; $t_0 = k\ T$; siendo T el tiempo de muestreo; y asumiendo que para $t > \tau > t_0$ la actuación *'u(t)'* permanece constante e igual a su valor al inicial del intervalo, se obtiene que:

$$x\left((k+1)T\right) = e^{A\cdot T}\, x\left(kT\right) + \left[\int_{kT}^{(k+1)T} e^{A\cdot T} B \cdot d\tau\right] \cdot u\left(kT\right); \quad [14]$$

Comparando esta ecuación con la ecuación de estado de un sistema discreto, queda[4]:

$$x(k+1) = \hat{A}(T)\cdot x(k) + \hat{B}(T)\cdot u(k);\ \hat{A}(T) \equiv e^{AT};\ \hat{B}(T) \equiv \int_{kT}^{(k+1)T} e^{AT} B \cdot d\tau; \quad [15]$$

[4] Hemos retirado, por comodidad en la notación, la dependencia con *'T'* de la variable de estado y de la señal de actuación.

6.3 Código para "Controlador.mdl".

6.3.1 Informe de la Generación de Código para *"Controlador.mdl"*.

- Code Generation Report for Controlador
  - Summary

    Real-Time Workshop code generated for Simulink model "Controlador.mdl".

  - Model Version : 1.3
  - Real-Time Workshop file version : 5.0 $Date: 2002/05/30 19:21:33 $
  - Real-Time Workshop file generated on : Tue Sep 23 20:35:03 2003
  - TLC version : 5.0 (Jun 18 2002)
  - C source code generated on : Tue Sep 23 20:35:05 2003
  - Relevant TLC Options
    - RollThreshold : 5
    - CodeFormat : Embedded-C
  - Simulink model settings
    - Solver : FixedStep
    - FixedStep : 0.001 s
- Optimisations

The following table lists selected code generation options. Options prefixed with an ellipsis (...) depend on a main configuration option. Settings which result in less efficient code are marked in *italic*.

Optimisation Types	Value [On/Off]	Optimisation Types	Value [On/Off]
Block reduction	on	Single output/update function	on
Boolean logic signals	on	MAT-file logging	off
Parameter pooling	on	Inline invariant signals	*off*
Inline Parameters	*off*	Initialise internal data	*on*
Signal storage reuse . . .buffer reuse . . .Local block outputs	on on on	Initialise external I/O data	*on*
Expression folding . . . Fold Unrolled vectors	on on	Conditional input branch	on

- Enforce integer downcast

The code generation option Enforce integer downcast refers to 8-bit operations on 16-bit microprocessors, and 8 and 16-bit operations on 32-bit microprocessors. To insure consistency between simulation and code generation, the results of expressions involving 8 and 16-bit integer signals must be explicitly downcasted. Deselecting this option improves code efficiency. The primary effect of deselecting this option is that expressions involving 8 and 16-bit arithmetic are less likely to overflow in code than they are in simulation. We recommend that you turn this option on for safety. Turn the option off only if you are concerned with generating the smallest possible code, and you know that 8 and 16-bit signals will not overflow. Currently, the option is on in this model.

- Static code dependencies

The generated code depends on these header files.

- Relative path from the MATLAB root directory
  - extern/include/tmwtypes.h
  - simulink/include/simstruc_types.h
  - rtw/c/libsrc/rtlibsrc.h

The generated code depends on the external functions located in ($MATLAB_ROOT)/rtw/c/libsrc.

- Data initialisation

Non-zero, non-static data is always initialised. Initialising data to zero may be redundant for your application. Initialisation code is optionally generated with the Initialise internal data and Initialise external I/O data options.

- Additional information
  - Use of Data Types
  - Interfacing Signals to External Code
  - Preserving function names

6.3.2 Códigos Fuente y Librerías generadas para “Controlador.mdl”.

Estos archivos se encuentran dentro del directorio:

“...\Matlab\work\Controlador_arm7tdmi”.

6.3.2.1 Código Fuente de “ert_main.c”.

```
/*
 * Auto generated example main program for model: Controlador
 *
 * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
 * Real-Time Workshop file generated on : Tue Sep 23 20:35:03 2003
 * C source code generated on           : Tue Sep 23 20:35:05 2003
 *
 * Description:
 *   Real-Time Workshop Embedded Coder example single rate main assuming
 *   no operating system.
 *
 * For more information:
 *   o Real-Time Workshop User's Guide
 *   o Real-Time Workshop Embedded Coder User's Guide
 *   o matlabroot/rtw/c/ert/ert_main.c
 *   o Type 'ecodertutorial' in MATLAB
 *
 * For a real-time operating system deployment example, reconfigure the
 * "Target operating system" option to "VxWorksExample".
 */

#include <stdio.h>                  /* This ert_main.c example uses printf/fflush */
#include "tmwtypes.h"               /* MathWorks types */
#include "simstruc_types.h"         /* Simulink types */
#include "Controlador.h"            /* Model's header file */

static boolean_T OverrunFlag = 0;

/* Associating rt_OneStep with a real-time clock or interrupt service routine
 * is what makes the generated code "real-time".  The function rt_OneStep is
 * always associated with the base rate of the model.  Subrates are managed
 * by the base rate from inside the generated code.  Enabling/disabling
 * interrupts and floating point context switches are target specific.  This
 * example code indicates where these should take place relative to executing
 * the generated code step function.  Overrun behavior should be tailored to
 * your application needs.  This example simply sets an error status in the
 * real-time model and returns from rt_OneStep.
 */
void rt_OneStep(void)
{
  /* Disable interrupts here */

  /* Check for overun */
  if (OverrunFlag++) {
    rtmSetErrorStatus(Controlador_M, "Overrun");
    return;
  }

  /* Save FPU context here (if necessary) */
  /* Re-enable timer or interrupt here */
  /* Set model inputs here */

  Controlador_step();

  /* Get model outputs here */

  OverrunFlag--;

  /* Disable interrupts here */
  /* Restore FPU context here (if necessary) */
  /* Enable interrupts here */
}

```

```
64  /* The example "main" function illustrates what is required by your
65   * application code to initialize, execute, and terminate the generated code.
66   * Attaching rt_OneStep to a real-time clock is target specific.  This example
67   * illustates how you do this relative to initializing the model.
68   */
69  int_T main(int_T argc, const char_T *argv[])
70  {
71
72    printf("Warning: The simulation will run forever. "
73     "To change this behavior select the 'MAT-file logging' option.\n");
74    fflush(NULL);
75
76    /* Initialize model */
77    Controlador_initialize(1);
78
79    /* Attach rt_OneStep to a timer or interrupt service routine with
80     * period 0.001 seconds (the model's base sample time) here.  The
81     * call syntax for rt_OneStep is
82     *
83     * rt_OneStep();
84     */
85
86    while (rtmGetErrorStatus(Controlador_M) == NULL) {
87      /* Perform other application tasks here */
88    }
89
90    /* Disable rt_OneStep() here */
91
92    /* Terminate model */
93    Controlador_terminate();
94    return 0;
95  }
96
```

6.3.2.2 Código Fuente de “Controlador.c”.

```
1   /*
2    * Real-Time Workshop code generation for Simulink model "Controlador.mdl".
3    *
4    * Model Version                        : 1.3
5    * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
6    * Real-Time Workshop file generated on : Tue Sep 23 20:35:03 2003
7    * TLC version                         : 5.0 (Jun 18 2002)
8    * C source code generated on          : Tue Sep 23 20:35:05 2003
9    */
10
11  #include "Controlador.h"
12  #include "Controlador_private.h"
13
14  /* Block signals (auto storage) */
15  BlockIO_Controlador Controlador_B;
16
17  /* Block states (auto storage) */
18  D_Work_Controlador Controlador_DWork;
19
20  /* External inputs (root inport signals with auto storage) */
21  ExternalInputs_Controlador Controlador_U;
22
23  /* External output (root outports fed by signals with auto storage) */
24  ExternalOutputs_Controlador Controlador_Y;
25
26  /* Real-time model */
27  RT_MODEL_Controlador Controlador_M_;
28  RT_MODEL_Controlador *Controlador_M = &Controlador_M_;
29
30  /* Model step function */
31  void Controlador_step(void)
32  {
33    /* local block i/o variables */
34    real_T rtb_Gain;
35    real_T rtb_Gain1;
36    real_T rtb_Gain2;
37    real_T rtb_Gain3;
```

```
38   real_T rtb_a[4];
39   real_T rtb_Maximo;
40   real_T rtb_Product[4];
41   real_T rtb_Multiport_Switch;
42   real_T rtb_Switch3;
43   real_T rtb_Switch2;
44   real_T rtb_Switch1;
45   real_T rtb_Switch;
46   real_T rtb_Switch4;
47   real_T rtb_fila1[11];
48   real_T rtb_fila2[11];
49   real_T rtb_fila3[11];
50   real_T rtb_fila4[11];
51   real_T rtb_Matrix_Concatenation[44];
52
53   /* Gain: '<S1>/Gain' incorporates:
54    *   Inport: '<Root>/In: estado'
55    *
56    * Regarding '<S1>/Gain':
57    *   Gain value: Controlador_P.Gain_Gain
58    */
59   rtb_Gain = Controlador_U.In_estado[0] * Controlador_P.Gain_Gain;
60
61   /* Gain: '<S1>/Gain1' incorporates:
62    *   Inport: '<Root>/In: estado'
63    *
64    * Regarding '<S1>/Gain1':
65    *   Gain value: Controlador_P.Gain1_Gain
66    */
67   rtb_Gain1 = Controlador_U.In_estado[1] * Controlador_P.Gain1_Gain;
68
69   /* Gain: '<S1>/Gain2' incorporates:
70    *   Inport: '<Root>/In: estado'
71    *
72    * Regarding '<S1>/Gain2':
73    *   Gain value: Controlador_P.Gain2_Gain
74    */
75   rtb_Gain2 = Controlador_U.In_estado[2] * Controlador_P.Gain2_Gain;
76
77   /* Gain: '<S1>/Gain3' incorporates:
78    *   Inport: '<Root>/In: estado'
79    *
80    * Regarding '<S1>/Gain3':
81    *   Gain value: Controlador_P.Gain3_Gain
82    */
83   rtb_Gain3 = Controlador_U.In_estado[8] * Controlador_P.Gain3_Gain;
84
85   /* Abs: '<S1>/Abs' */
86   rtb_a[0] = fabs(rtb_Gain);
87   rtb_a[1] = fabs(rtb_Gain1);
88   rtb_a[2] = fabs(rtb_Gain2);
89   rtb_a[3] = fabs(rtb_Gain3);
90
91   /* MinMax: '<S1>/Maximo' */
92   {
93     real_T rtmax = rtb_a[0];
94
95     rtmax = rt_MAX(rtb_a[1], rtmax);
96     rtmax = rt_MAX(rtb_a[2], rtmax);
97     rtmax = rt_MAX(rtb_a[3], rtmax);
98     rtb_Maximo = rtmax;
99   }
100
101  /* RelationalOperator: '<S1>/Igualdad' incorporates:
102   *   Product: '<S1>/Producto'
103   *   Constant: '<S1>/Constant'
104   */
105  Controlador_B.Igualdad[0] = ((Controlador_P.Constant_Value[0] * rtb_Maximo) ==
106    rtb_a[0]);
107  Controlador_B.Igualdad[1] = ((Controlador_P.Constant_Value[1] * rtb_Maximo) ==
108    rtb_a[1]);
109  Controlador_B.Igualdad[2] = ((Controlador_P.Constant_Value[2] * rtb_Maximo) ==
110    rtb_a[2]);
111  Controlador_B.Igualdad[3] = ((Controlador_P.Constant_Value[3] * rtb_Maximo) ==
112    rtb_a[3]);
113
```

```
114   /* S-Function "primerNoNulo_wrapper" Block: <S1>/S-Function */
115
116   primerNoNulo_Outputs_wrapper(&Controlador_B.Igualdad[0],
117    &Controlador_B.S_Function );
118
119   /* Switch: '<S1>/Switch4' incorporates:
120    *   Sum: '<S1>/Sum'
121    *   Constant: '<S1>/Movimiento Tipo'
122    */
123   if ((rtb_a[0] + rtb_a[1] + rtb_a[2] + rtb_a[3]) >=
124    Controlador_P.Switch4_Threshold) {
125
126     /* MultiPortSwitch: '<S1>/Multiport Switch' */
127     switch (((int_T)Controlador_B.S_Function)+1) {
128      case 1:
129
130       /* Switch: '<S1>/Switch' incorporates:
131        *   Constant: '<S1>/Movimiento Tipo'
132        */
133       if (rtb_Gain >= Controlador_P.Switch_Threshold) {
134         rtb_Switch = Controlador_P.Movimiento_Tipo_Value[1];
135       } else {
136         rtb_Switch = Controlador_P.Movimiento_Tipo_Value[2];
137       }
138
139       rtb_Multiport_Switch = rtb_Switch;
140       break;
141      case 2:
142
143       /* Switch: '<S1>/Switch1' incorporates:
144        *   Constant: '<S1>/Movimiento Tipo'
145        */
146       if (rtb_Gain1 >= Controlador_P.Switch1_Threshold) {
147         rtb_Switch1 = Controlador_P.Movimiento_Tipo_Value[3];
148       } else {
149         rtb_Switch1 = Controlador_P.Movimiento_Tipo_Value[4];
150       }
151
152       rtb_Multiport_Switch = rtb_Switch1;
153       break;
154      case 3:
155
156       /* Switch: '<S1>/Switch2' incorporates:
157        *   Constant: '<S1>/Movimiento Tipo'
158        */
159       if (rtb_Gain2 >= Controlador_P.Switch2_Threshold) {
160         rtb_Switch2 = Controlador_P.Movimiento_Tipo_Value[5];
161       } else {
162         rtb_Switch2 = Controlador_P.Movimiento_Tipo_Value[6];
163       }
164
165       rtb_Multiport_Switch = rtb_Switch2;
166       break;
167      case 4:
168
169       /* Switch: '<S1>/Switch3' incorporates:
170        *   Constant: '<S1>/Movimiento Tipo'
171        */
172       if (rtb_Gain3 >= Controlador_P.Switch3_Threshold) {
173         rtb_Switch3 = Controlador_P.Movimiento_Tipo_Value[7];
174       } else {
175         rtb_Switch3 = Controlador_P.Movimiento_Tipo_Value[8];
176       }
177
178       rtb_Multiport_Switch = rtb_Switch3;
179       break;
180      default:
181       /* Result undefined */
182   #if defined(MATLAB_MEX_FILE)
183       (void)mexPrintf("Error: Invalid control input for block:"
184        "Controlador/Método de Ajuste: Decisor/Multiport Switch\n"
185        "Result is undefined.");
186   #endif
187       break;
188     }
189
```

```
190     rtb_Switch4 = rtb_Multiport_Switch;
191   } else {
192     rtb_Switch4 = Controlador_P.Movimiento_Tipo_Value[0];
193   }
194
195   /* Selector: '<Root>/Selector' incorporates:
196    *   Constant: '<Root>/Matriz de filas 1 de K0,...,K8'
197    */
198   Controlador_DWork.Selector_DWORK2 = (int32_T)(rtb_Switch4)-1;
199
200   {
201     int_T i1;
202
203     const real_T *u0 = &Controlador_P.Matriz_de_filas_1_de_K0_K8_Valu[0];
204     real_T *y0 = &rtb_fila1[0];
205
206     for (i1=0; i1 < 11; i1++) {
207       y0[i1] = u0[(9*i1)+Controlador_DWork.Selector_DWORK2];
208     }
209   }
210
211   /* Selector: '<Root>/Selector1' incorporates:
212    *   Constant: '<Root>/Matriz de filas 2 de K0,...,K8'
213    */
214   Controlador_DWork.Selector1_DWORK2 = (int32_T)(rtb_Switch4)-1;
215
216   {
217     int_T i1;
218
219     const real_T *u0 = &Controlador_P.Matriz_de_filas_2_de_K0_K8_Valu[0];
220     real_T *y0 = &rtb_fila2[0];
221
222     for (i1=0; i1 < 11; i1++) {
223       y0[i1] = u0[(9*i1)+Controlador_DWork.Selector1_DWORK2];
224     }
225   }
226
227   /* Selector: '<Root>/Selector2' incorporates:
228    *   Constant: '<Root>/Matriz de filas 3 de K0,...,K1'
229    */
230   Controlador_DWork.Selector2_DWORK2 = (int32_T)(rtb_Switch4)-1;
231
232   {
233     int_T i1;
234
235     const real_T *u0 = &Controlador_P.Matriz_de_filas_3_de_K0_K1_Valu[0];
236     real_T *y0 = &rtb_fila3[0];
237
238     for (i1=0; i1 < 11; i1++) {
239       y0[i1] = u0[(9*i1)+Controlador_DWork.Selector2_DWORK2];
240     }
241   }
242
243   /* Selector: '<Root>/Selector3' incorporates:
244    *   Constant: '<Root>/Matriz de filas 4 de K0,...,K2'
245    */
246   Controlador_DWork.Selector3_DWORK2 = (int32_T)(rtb_Switch4)-1;
247
248   {
249     int_T i1;
250
251     const real_T *u0 = &Controlador_P.Matriz_de_filas_4_de_K0_K2_Valu[0];
252     real_T *y0 = &rtb_fila4[0];
253
254     for (i1=0; i1 < 11; i1++) {
255       y0[i1] = u0[(9*i1)+Controlador_DWork.Selector3_DWORK2];
256     }
257   }
258
259   /*
260    * Matrix Concatenation: <Root>/Matrix Concatenation
261    * Vertical matrix concatenation,
262    * 4 inputs, real, data type: real_T.
263    */
264   {
265     const int_T nCols = 11;
```

```
266     int_T colNum;
267     for ( colNum = 0; colNum < nCols; colNum++ ) {
268       (void) memcpy( ((byte_T *)(&rtb_Matrix_Concatenation[0])) + (colNum *
269         4*sizeof(real_T)),
270         ((byte_T *)(&rtb_fila1[0])) + (colNum * 1 * sizeof(real_T)), 1 *
271         sizeof(real_T) );               /* Input 1: [1x11], 1 * sizeof(real_T) bytes per col */
272       (void) memcpy( ((byte_T *)(&rtb_Matrix_Concatenation[0])) + (colNum *
273         4*sizeof(real_T)) + 1*sizeof(real_T),
274         ((byte_T *)(&rtb_fila2[0])) + (colNum * 1 * sizeof(real_T)), 1 *
275         sizeof(real_T) );               /* Input 2: [1x11], 1 * sizeof(real_T) bytes per col */
276       (void) memcpy( ((byte_T *)(&rtb_Matrix_Concatenation[0])) + (colNum *
277         4*sizeof(real_T)) + 2*sizeof(real_T),
278         ((byte_T *)(&rtb_fila3[0])) + (colNum * 1 * sizeof(real_T)), 1 *
279         sizeof(real_T) );               /* Input 3: [1x11], 1 * sizeof(real_T) bytes per col */
280       (void) memcpy( ((byte_T *)(&rtb_Matrix_Concatenation[0])) + (colNum *
281         4*sizeof(real_T)) + 3*sizeof(real_T),
282         ((byte_T *)(&rtb_fila4[0])) + (colNum * 1 * sizeof(real_T)), 1 *
283         sizeof(real_T) );               /* Input 4: [1x11], 1 * sizeof(real_T) bytes per col */
284     }
285   }
286
287   /* Product: '<Root>/Product' incorporates:
288    *   Inport: '<Root>/In: error'
289    */
290   {
291     static const int dims[1][3] = { { 4, 11, 1 } };
292     rt_MatMultRR_Dbl((real_T *)&rtb_Product[0], (real_T
293       *)&rtb_Matrix_Concatenation[0],
294      (real_T *)&Controlador_U.In_error[0], &dims[0][0]);
295   }
296
297   /* Outport: '<Root>/Out: actuación' incorporates:
298    *   Saturate: '<Root>/Saturation'
299    *
300    * Regarding '<Root>/Saturation':
301    *   Lower limit: Controlador_P.Saturation_LowerSat
302    *   Upper limit: Controlador_P.Saturation_UpperSat
303    */
304   Controlador_Y.Out_actuaci_n[0] =
305     rt_SATURATE(rtb_Product[0],Controlador_P.Saturation_LowerSat,Controlador_P.Saturation_UpperSat);
306   Controlador_Y.Out_actuaci_n[1] =
307     rt_SATURATE(rtb_Product[1],Controlador_P.Saturation_LowerSat,Controlador_P.Saturation_UpperSat);
308   Controlador_Y.Out_actuaci_n[2] =
309     rt_SATURATE(rtb_Product[2],Controlador_P.Saturation_LowerSat,Controlador_P.Saturation_UpperSat);
310   Controlador_Y.Out_actuaci_n[3] =
311     rt_SATURATE(rtb_Product[3],Controlador_P.Saturation_LowerSat,Controlador_P.Saturation_UpperSat);
312
313   /* (no update code required) */
314 }
315
316 /* Model initialize function */
317 void Controlador_initialize(boolean_T firstTime)
318 {
319   if (firstTime) {
320     /* registration code */
321     rtmSetErrorStatus(Controlador_M, (const char_T *)0);
322
323     /* block I/O */
324     {
325       void *b = (void *) &Controlador_B;
326       (void)memset(b, 0, sizeof(BlockIO_Controlador));
327
328       {
329         int_T i;
330
331         b =&Controlador_B.S_Function;
332         for (i = 0; i < 1; i++) {
333           ((real_T*)b)[i] = 0.0;
334         }
335       }
336     }
337
338     /* data type work */
339     (void)memset((char_T *) &Controlador_DWork, 0, sizeof(D_Work_Controlador));
340
341     /* external inputs */
```

```
342     {
343       int_T i;
344
345       for (i = 0; i < 11; i++) {
346         Controlador_U.In_error[i] = 0.0;
347       }
348     }
349     {
350       int_T i;
351
352       for (i = 0; i < 11; i++) {
353         Controlador_U.In_estado[i] = 0.0;
354       }
355     }
356
357     /* external outputs */
358     {
359       int_T i;
360
361       for (i = 0; i < 4; i++) {
362         Controlador_Y.Out_actuaci_n[i] = 0.0;
363       }
364     }
365   }
366 }
367
368 /* Model terminate function */
369 void Controlador_terminate(void)
370 {
371   /* (no terminate code required) */
372 }
373
```

6.3.2.3 Código Fuente de “Controlador_data.c”.

```
1  /*
2   * Controlador_data.c
3   *
4   * Real-Time Workshop code generation for Simulink model "Controlador.mdl".
5   *
6   * Model Version                        : 1.3
7   * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
8   * Real-Time Workshop file generated on : Tue Sep 23 20:35:03 2003
9   * TLC version                          : 5.0 (Jun 18 2002)
10  * C source code generated on           : Tue Sep 23 20:35:05 2003
11  */
12
13 #include "Controlador.h"
14 #include "Controlador_private.h"
15
16 /* Block parameters (auto storage) */
17 Parameters_Controlador Controlador_P = {
18   /*  Matriz_de_filas_1_de_K0_K8_Valu : '<Root>/Matriz de filas 1 de K0,...,K8' */
19   { -1.749085302841867E-002, 1.559719700754612 9E+000, -2.1618378966277305E+000,
20     1.6010523197799102E+000, -3.9288396660949729E+000, -2.0646215016022325E+000,
21     -1.7522249091416597E+000, -2.6370188496732272E+000,
22     -2.0478266084293408E+000, 1.1419642091674806E-002, -5.9592871757722605E+000,
23     9.5151974903601522E-001, -1.9063752233438294E+000, -3.0428187746694846E+000,
24     -4.8815099438652396E+000, -3.3030715528875589E+000, 2.3137653027808236E+000,
25     -2.8268962797766566E+000, -5.2171632858085633E-002,
26     -1.3293970376253128E-001, -1.7559909820556642E-002, 8.3060650377534326E+000,
27     -1.9374937225133181E+001, -1.8816714785527438E+001,
28     -2.0738728034542874E+001, -4.3869856639154134E+000,
29     -4.6808096141228814E+000, 0.0701783825, -1.3232219582796097E+002,
30     6.0105908107757571E+001, -8.7999502426391700E+000, -5.9241061651846394E+000,
31     -1.6265705108642578E+001, -4.2767456054687500E+001,
32     -4.4737613288316425E+000, 7.1000061967621155E+000, -1.2880330625000000E-002,
33     -1.2676279578357935E+001, 5.5934498786926277E+000, -7.2518767639296131E+000,
34     -3.7456887979060411E+000, -2.9454203844070435E+000,
35     -2.0268554687500000E+000, -1.2970765055273858E+000, 1.2233454634714691E+000,
36     1.1082803250000001E-001, -1.2883367389440536E+002, 6.4773495101928717E+001,
37     -6.1573984403721994E+001, -3.0342882171273232E+001,
38     -1.0362178802490234E+001, 1.4515533447265625E+001, 6.9691200026376920E+000,
39     1.0338552523629915E+001, 6.1888817187499999E-003, -6.2078418005257845E+000,
```

```
 40     3.1808090955018997E+000, -2.3055323782260531E+000, -1.0984753286466002E+000,
 41     -5.3534084558486938E-001, 6.3430023193359375E-001, 1.3351056989783958E-001,
 42     2.0513898774588599E-001, -4.3915734039306641E-004, -2.4909965131955687E+000,
 43     -3.7974998814461292E-001, -6.4974580891430378E-003, 1.5094181150197983E-001,
 44     1.0461698565632105E-001, 2.0913183689117432E-003, 1.7703865328801954E-001,
 45     -3.7737143759195535E-001, -2.7452140625000001E-004,
 46     -5.1782332174479961E+000, 3.9735789835453037E+000, -5.6890453650034036E+000,
 47     6.9307880755513906E-001, 1.3960015773773193E-001, 2.3864746093750000E-002,
 48     -1.3998390641066181E+000, 2.2988564244132705E+000, 0.10093866,
 49     -1.2734173262119293E+002, 5.9841438770294189E+001, -5.8351954557932913E+001,
 50     -2.8096175119280815E+001, -2.2082702636718750E+001,
 51     -2.8585815429687500E+000, 1.0519968995831277E+000, 1.1411396743883234E+001,
 52     0.101797895, -1.0963275265693665E+002, 6.0848979568481447E+001,
 53     -6.2469401582889262E+001, -2.1979507356882095E+001,
 54     -7.2698593139648438E+000, -5.6488037109375000E-002,
 55     -2.3771630854051184E+000, 1.6539093900528680E+001 } ,
 56   /*  Constant_Value : '<S1>/Constant' */
 57   { 1.0, 1.0, 1.0, 1.0 } ,
 58   0.1965 ,                      /* Gain_Gain : '<S1>/Gain' */
 59   0.1965 ,                      /* Gain1_Gain : '<S1>/Gain1' */
 60   0.1965 ,                      /* Gain2_Gain : '<S1>/Gain2' */
 61   0.9549 ,                      /* Gain3_Gain : '<S1>/Gain3' */
 62   /*  Movimiento_Tipo_Value : '<S1>/Movimiento Tipo' */
 63   { 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0 } ,
 64   0.25 ,                        /* Switch4_Threshold : '<S1>/Switch4' */
 65   /*  Matriz_de_filas_2_de_K0_K8_Valu : '<Root>/Matriz de filas 2 de K0,...,K8' */
 66   { 1.8990501694183350E-002, 5.6114387471443479E+000, 4.3328310114238775E+000,
 67     5.9957300872524684E+000, 4.5231270302019766E+000, 2.8486745217815042E+000,
 68     3.6621665954589844E+000, 4.6159064025601424E+000, -2.2764371498626588E+000,
 69     -1.2434991767578125E-002, 7.0977399284220155E+000, -7.8470990621708552E+000,
 70     7.8699272698313791E+000, 7.5768351874405653E+000, 7.8091350169852376E+000,
 71     8.5256451927125454E+000, 9.4346227803093718E+000, 1.0320843347192181E+001,
 72     -4.7720295597648621E-002, -6.7481406033039093E-002,
 73     -1.9074261188507080E-002, 3.2517734323628247E+000, -1.0503685554489493E+001,
 74     -1.2064395977649838E+001, -8.3367304147686809E+000, 3.4437520439132641E-001,
 75     4.5861955825887435E+000, -1.1620364750000001E-001, -5.8804708898067474E+001,
 76     5.5636467933654785E+001, 3.3149831260001520E+001, 2.1602444895252120E+001,
 77     2.1212223052978516E+001, 8.6396636962890625E+001, 3.7629335476478786E+001,
 78     9.4061353356477412E+001, 1.7959085624999999E-002, -5.1684302762150764E+000,
 79     6.7364124059677124E+000, -1.4921758635900915E+000, -1.0865991013124585E+000,
 80     3.9912909269332886E+000, 4.1824645996093750E+000, 2.6258190457295427E+000,
 81     1.2556598991947567E+001, -1.5974787250000000E-001, -7.8658159732818604E+001,
 82     5.0274635314941406E+001, -9.0641229880973697E+001, -1.0216060280054808E+002,
 83     1.3066364288330078E+001, -3.1005615234375000E+001, -2.8187459590706112E+001,
 84     8.8890034057532830E+001, -9.0322995312499994E-003, -4.0356271769851446E+000,
 85     2.0928173959255219E+000, -3.5258246697485447E+000, -4.1375554660335183E+000,
 86     -5.7435518503189087E-001, 3.5797119140625000E-002, -1.0215602625844582E+000,
 87     2.3981662553762249E+000, 5.4116933944702147E-004, -1.3465857748378767E+000,
 88     -4.4327799341408536E-001, -2.5678733363747597E-003, 8.2102905958890915E-002,
 89     -1.3388674706220627E-001, -4.0675252676010132E-003,
 90     -8.9429663659382186E-001, -3.9257070861407328E-001, 5.6904953125000001E-004,
 91     -6.9596065655350685E+000, -7.7333170175552368E-001,
 92     -3.8974132505245507E+000, -1.0026999614201486E+000,
 93     -1.7822659015655518E-001, -4.3884277343750000E-002,
 94     -1.8606343804343339E+000, 6.8151298404668523E+000, -0.14899377,
 95     -6.4680329084396362E+001, 6.0356975078582764E+001, -5.8998104607686400E+001,
 96     -6.4656054235994816E+001, 2.5972267150878906E+001, 5.5989990234375000E+000,
 97     -9.8111910461789194E+000, 9.3350903587019275E+001, -0.149886215,
 98     -8.4137099862098694E+001, 3.4084982872009277E+001, -6.2918022431433201E+001,
 99     -5.9967593729496002E+001, 7.4645996093750000E+000, 2.0471191406250000E-001,
100      -2.3407949862634268E+001, 9.0919963887727135E+001 } ,
101    /*  Matriz_de_filas_3_de_K0_K1_Valu : '<Root>/Matriz de filas 3 de K0,...,K1' */
102    { 1.2414272613525391E+001, -1.8176773391672669E+000, -1.7008653354339005E+000,
103      -1.6005370624605122E+000, -1.7903287444066565E+000,
104      -2.0016017883550377E+000, -2.0434045146219435E+000,
105      -8.1574172700310754E-001, 3.0896117519909017E-001, 1.8570939712524414E+001,
106      8.3990988801947430E-001, -1.3018465309929981E+000, 9.9731921430401371E-001,
107      1.2909845553630612E+000, 6.2025329456664624E-001, 9.0540395629650450E-001,
108      8.6126994368130827E-001, 1.1283661728326422E+000, -6.3161268234252929E-002,
109      -1.4034537784755231E-002, 2.8828501701354983E-003, 2.6862606836715717E+000,
110      7.9902293742634356E-001, 7.6855874946340927E-002, 1.4209227187529905E-001,
111      4.4925114890961542E+000, -4.2977721953917296E+000, 63.6225,
112      -1.2141338695585729E+001, -1.1713651359081268E+001, 4.7969192379619932E+000,
113      2.6852488518372413E+000, 9.0433303833007823E+000, 1.3193332433700562E+001,
114      3.6035762500495938E+000, -2.7848481972587252E-001, 1.3410703125000000E+001,
115      -1.2352051520720124E+000, -1.1048584192991258E+000, 9.9888197239488372E-002,
```

```
116     1.6046243104618043E+000, 9.3041967153549199E-001, 1.7091275215148927E+000,
117     -5.0778482057248198E-001, -8.0460905335941679E-001, -37.31125,
118     -6.8155892536044123E+000, -3.7066887021064758E+000, 7.6036636114120491E+000,
119     2.5441491232439876E+001, 1.0068699264526368E+001, 2.5468594217300417E+001,
120     4.3296257279773731E-001, -1.9591454330967737E+000, -1.9959765625000001E+000,
121     1.4585990644991399E-002, 1.3592170476913454E-001, 4.1051244910340756E-001,
122     1.1026389671373182E+000, 1.0179392576217652E+000, 1.8056552469730378E+000,
123     3.0097102056768182E-001, 4.1903744519521530E-002, -1.0050399780273438E-001,
124     -3.1473180278735530E-001, 6.4206780837776020E-002, -2.0885509904474023E-003,
125     -6.2796941958367831E-003, -7.7954768459312623E-002,
126     -2.6527556823566557E-003, 4.6647668876194363E-002, 8.1805327285564999E-002,
127     -0.040546875, -1.5111952797509731E+000, -1.5954027891159059E+000,
128     -3.4125932438764722E-001, 6.6871449277969086E-001, -1.1526443362236023E-001,
129     -8.2173252105712899E-002, -9.6625725647223182E-001,
130     -9.7902261262197499E-001, -31.2075, -6.7125525072216989E+000,
131     -3.8353798270225528E+000, 8.6290113979950558E+000, 2.3672898993454876E+001,
132     1.8487770652770998E+001, 8.4422605991363522E+000, 2.1080081816018494E+000,
133     6.4723013290404197E-002, -64.15875, -2.2437994165718557E+001,
134     -2.0450052058696748E+001, -4.4060865147039294E+000, 1.0761781365610659E+001,
135     -3.5877298355102543E+000, -8.5558681488037114E-001,
136     -1.3226476446618950E+001, -1.3026438595488527E+001 } ,
137   /*  Matriz_de_filas_4_de_K0_K2_Valu : '<Root>/Matriz de filas 4 de K0,...,K2' */
138   { -1.2414272613525391E+001, 1.8176773391672669E+000, 1.7008653354339005E+000,
139     1.6005370624605122E+000, 1.7903287444066565E+000, 2.0016017883550377E+000,
140     2.0434045146219435E+000, 8.1574172700310754E-001, -3.0896117519909017E-001,
141     -1.8570939712524414E+001, -8.3990988801947430E-001, 1.3018465309929981E+000,
142     -9.9731921430401371E-001, -1.2909845553630612E+000,
143     -6.2025329456664624E-001, -9.0540395629650450E-001,
144     -8.6126994368130827E-001, -1.1283661728326422E+000, 6.3161268234252929E-002,
145     1.4034537784755231E-002, -2.8828501701354983E-003, -2.6862606836715717E+000,
146     -7.9902293742634356E-001, -7.6855874946340927E-002,
147     -1.4209227187529905E-001, -4.4925114890961542E+000, 4.2977721953917296E+000,
148     -63.6225, 1.2141338695585729E+001, 1.1713651359081268E+001,
149     -4.7969192379619932E+000, -2.6852488518372413E+000,
150     -9.0433303833007823E+000, -1.3193332433700562E+001,
151     -3.6035762500495938E+000, 2.7848481972587252E-001, -1.3410703125000000E+001,
152     1.2352051520720124E+000, 1.1048584192991258E+000, -9.9888197239488372E-002,
153     -1.6046243104618043E+000, -9.3041967153549199E-001,
154     -1.7091275215148927E+000, 5.0778482057248198E-001, 8.0460905335941679E-001,
155     37.31125, 6.8155892536044123E+000, 3.7066887021064758E+000,
156     -7.6036636114120491E+000, -2.5441491232439876E+001,
157     -1.0068699264526368E+001, -2.5468594217300417E+001,
158     -4.3296257279773731E-001, 1.9591454330967737E+000, 1.9959765625000001E+000,
159     -1.4585990644991399E-002, -1.3592170476913454E-001,
160     -4.1051244910340756E-001, -1.1026389671373182E+000,
161     -1.0179392576217652E+000, -1.8056552469730378E+000,
162     -3.0097102056768182E-001, -4.1903744519521530E-002, 1.0050399780273438E-001,
163     3.1473180278735530E-001, -6.4206780837776020E-002, 2.0885509904474023E-003,
164     6.2796941958367831E-003, 7.7954768459312623E-002, 2.6527556823566557E-003,
165     -4.6647668876194363E-002, -8.1805327285564999E-002, 0.040546875,
166     1.5111952797509731E+000, 1.5954027891159059E+000, 3.4125932438764722E-001,
167     -6.6871449277969086E-001, 1.1526443362236023E-001, 8.2173252105712899E-002,
168     9.6625725647223182E-001, 9.7902261262197499E-001, 31.2075,
169     6.7125525072216989E+000, 3.8353798270225528E+000, -8.6290113979950558E+000,
170     -2.3672898993454876E+001, -1.8487770652770998E+001,
171     -8.4422605991363522E+000, -2.1080081816018494E+000,
172     -6.4723013290404197E-002, 64.15875, 2.2437994165718557E+001,
173     2.0450052058696748E+001, 4.4060865147039294E+000, -1.0761781365610659E+001,
174     3.5877298355102543E+000, 8.5558681488037114E-001, 1.3226476446618950E+001,
175     1.3026438595488527E+001 } ,
176   1.0 ,                   /* Saturation_UpperSat : '<Root>/Saturation' */
177   -1.0 ,                  /* Saturation_LowerSat : '<Root>/Saturation' */
178   0.0 ,                   /* Switch_Threshold : '<S1>/Switch' */
179   0.0 ,                   /* Switch1_Threshold : '<S1>/Switch1' */
180   0.0 ,                   /* Switch2_Threshold : '<S1>/Switch2' */
181   0.0                     /* Switch3_Threshold : '<S1>/Switch3' */
182 };
183
```

6.3.2.4 Código Fuente de “Controlador_sf.c”.

```
1  /*
2   * Controlador_sf.h
3   *
4   * This file contains a "wrapper style S-Function" for testing the generated
```

```
 5  * code from Simulink.  Simulink invokes the generated code through its
 6  * S-Function API.  Note that this file is not required for deployment
 7  * of the generated code outside of Simulink.
 8  *
 9  * Real-Time Workshop code generation for Simulink model "Controlador.mdl".
10  *
11  * Model Version                  : 1.3
12  * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
13  * Real-Time Workshop file generated on : Tue Sep 23 20:35:03 2003
14  * TLC version                    : 5.0 (Jun 18 2002)
15  * C source code generated on          : Tue Sep 23 20:35:05 2003
16  *
17  */
18
19 #if !defined(S_FUNCTION_NAME)
20 #define S_FUNCTION_NAME               Controlador_sf
21 #endif
22 #define S_FUNCTION_LEVEL              2
23
24 #include <stdio.h>
25 #include <math.h>
26 #include "simstruc.h"
27 #include "rt_nonfinite.h"
28
29 #define rt_logging_h
30 #include "Controlador.h"
31
32 static int8_T Controlador_sf_counter = 0;
33
34 #define MDL_CHECK_PARAMETERS
35 #if defined(MDL_CHECK_PARAMETERS) && defined(MATLAB_MEX_FILE)
36 static void mdlCheckParameters(SimStruct *S)
37 {
38   int i=0;
39
40   /* Parameter check for 'Matriz_de_filas_1_de_K0_K8_Valu' */
41   if (mxIsComplex(ssGetSFcnParam(S, 0))) {
42     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_1_de_K0_K8_Valu' has to be a non complex type.");
43     return;
44   }
45   if (!mxIsDouble(ssGetSFcnParam(S, 0))) {
46     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_1_de_K0_K8_Valu' has to be a double type.");
47     return;
48   }
49   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 0)) != 2) {
50     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_1_de_K0_K8_Valu' has to have 2 dimensions.");
51     return;
52   }
53   if (mxGetNumberOfElements(ssGetSFcnParam(S, 0)) != 99) {
54     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_1_de_K0_K8_Valu' has to have 99 elements.");
55     return;
56   }
57
58   for (i=0; i<99; i++) {
59
60     Controlador_P.Matriz_de_filas_1_de_K0_K8_Valu[i] = (real_T) (((real_T *)
61       mxGetData(ssGetSFcnParam(S, 0)))[i]);
62   }
63
64   /* Parameter check for 'Constant_Value' */
65   if (mxIsComplex(ssGetSFcnParam(S, 1))) {
66     ssSetErrorStatus(S,"Parameter 'Constant_Value' has to be a non complex type.");
67     return;
68   }
69   if (!mxIsDouble(ssGetSFcnParam(S, 1))) {
70     ssSetErrorStatus(S,"Parameter 'Constant_Value' has to be a double type.");
71     return;
72   }
73   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 1)) != 2) {
74     ssSetErrorStatus(S,"Parameter 'Constant_Value' has to have 2 dimensions.");
75     return;
76   }
77   if (mxGetNumberOfElements(ssGetSFcnParam(S, 1)) != 4) {
78     ssSetErrorStatus(S,"Parameter 'Constant_Value' has to have 4 elements.");
79     return;
80   }
```

```
81
82    for (i=0; i<4; i++) {
83
84      Controlador_P.Constant_Value[i] = (real_T) (((real_T *)
85        mxGetData(ssGetSFcnParam(S, 1)))[i]);
86    }
87
88    /* Parameter check for 'Gain_Gain' */
89    if (mxIsComplex(ssGetSFcnParam(S, 2))) {
90      ssSetErrorStatus(S,"Parameter 'Gain_Gain' has to be a non complex type.");
91      return;
92    }
93    if (!mxIsDouble(ssGetSFcnParam(S, 2))) {
94      ssSetErrorStatus(S,"Parameter 'Gain_Gain' has to be a double type.");
95      return;
96    }
97    if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 2)) != 2) {
98      ssSetErrorStatus(S,"Parameter 'Gain_Gain' has to have 2 dimensions.");
99      return;
100   }
101   if (mxGetNumberOfElements(ssGetSFcnParam(S, 2)) != 1) {
102     ssSetErrorStatus(S,"Parameter 'Gain_Gain' has to have 1 elements.");
103     return;
104   }
105
106   Controlador_P.Gain_Gain = (real_T) (((real_T *) mxGetData(ssGetSFcnParam(S,
107     2)))[0]);
108
109   /* Parameter check for 'Gain1_Gain' */
110   if (mxIsComplex(ssGetSFcnParam(S, 3))) {
111     ssSetErrorStatus(S,"Parameter 'Gain1_Gain' has to be a non complex type.");
112     return;
113   }
114   if (!mxIsDouble(ssGetSFcnParam(S, 3))) {
115     ssSetErrorStatus(S,"Parameter 'Gain1_Gain' has to be a double type.");
116     return;
117   }
118   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 3)) != 2) {
119     ssSetErrorStatus(S,"Parameter 'Gain1_Gain' has to have 2 dimensions.");
120     return;
121   }
122   if (mxGetNumberOfElements(ssGetSFcnParam(S, 3)) != 1) {
123     ssSetErrorStatus(S,"Parameter 'Gain1_Gain' has to have 1 elements.");
124     return;
125   }
126
127   Controlador_P.Gain1_Gain = (real_T) (((real_T *) mxGetData(ssGetSFcnParam(S,
128     3)))[0]);
129
130   /* Parameter check for 'Gain2_Gain' */
131   if (mxIsComplex(ssGetSFcnParam(S, 4))) {
132     ssSetErrorStatus(S,"Parameter 'Gain2_Gain' has to be a non complex type.");
133     return;
134   }
135   if (!mxIsDouble(ssGetSFcnParam(S, 4))) {
136     ssSetErrorStatus(S,"Parameter 'Gain2_Gain' has to be a double type.");
137     return;
138   }
139   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 4)) != 2) {
140     ssSetErrorStatus(S,"Parameter 'Gain2_Gain' has to have 2 dimensions.");
141     return;
142   }
143   if (mxGetNumberOfElements(ssGetSFcnParam(S, 4)) != 1) {
144     ssSetErrorStatus(S,"Parameter 'Gain2_Gain' has to have 1 elements.");
145     return;
146   }
147
148   Controlador_P.Gain2_Gain = (real_T) (((real_T *) mxGetData(ssGetSFcnParam(S,
149     4)))[0]);
150
151   /* Parameter check for 'Gain3_Gain' */
152   if (mxIsComplex(ssGetSFcnParam(S, 5))) {
153     ssSetErrorStatus(S,"Parameter 'Gain3_Gain' has to be a non complex type.");
154     return;
155   }
156   if (!mxIsDouble(ssGetSFcnParam(S, 5))) {
```

```
157     ssSetErrorStatus(S,"Parameter 'Gain3_Gain' has to be a double type.");
158     return;
159   }
160   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 5)) != 2) {
161     ssSetErrorStatus(S,"Parameter 'Gain3_Gain' has to have 2 dimensions.");
162     return;
163   }
164   if (mxGetNumberOfElements(ssGetSFcnParam(S, 5)) != 1) {
165     ssSetErrorStatus(S,"Parameter 'Gain3_Gain' has to have 1 elements.");
166     return;
167   }
168
169   Controlador_P.Gain3_Gain = (real_T) (((real_T *) mxGetData(ssGetSFcnParam(S,
170     5)))[0]);
171
172   /* Parameter check for 'Movimiento_Tipo_Value' */
173   if (mxIsComplex(ssGetSFcnParam(S, 6))) {
174     ssSetErrorStatus(S,"Parameter 'Movimiento_Tipo_Value' has to be a non complex type.");
175     return;
176   }
177   if (!mxIsDouble(ssGetSFcnParam(S, 6))) {
178     ssSetErrorStatus(S,"Parameter 'Movimiento_Tipo_Value' has to be a double type.");
179     return;
180   }
181   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 6)) != 2) {
182     ssSetErrorStatus(S,"Parameter 'Movimiento_Tipo_Value' has to have 2 dimensions.");
183     return;
184   }
185   if (mxGetNumberOfElements(ssGetSFcnParam(S, 6)) != 9) {
186     ssSetErrorStatus(S,"Parameter 'Movimiento_Tipo_Value' has to have 9 elements.");
187     return;
188   }
189
190   for (i=0; i<9; i++) {
191
192     Controlador_P.Movimiento_Tipo_Value[i] = (real_T) (((real_T *)
193       mxGetData(ssGetSFcnParam(S, 6)))[i]);
194   }
195
196   /* Parameter check for 'Switch4_Threshold' */
197   if (mxIsComplex(ssGetSFcnParam(S, 7))) {
198     ssSetErrorStatus(S,"Parameter 'Switch4_Threshold' has to be a non complex type.");
199     return;
200   }
201   if (!mxIsDouble(ssGetSFcnParam(S, 7))) {
202     ssSetErrorStatus(S,"Parameter 'Switch4_Threshold' has to be a double type.");
203     return;
204   }
205   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 7)) != 2) {
206     ssSetErrorStatus(S,"Parameter 'Switch4_Threshold' has to have 2 dimensions.");
207     return;
208   }
209   if (mxGetNumberOfElements(ssGetSFcnParam(S, 7)) != 1) {
210     ssSetErrorStatus(S,"Parameter 'Switch4_Threshold' has to have 1 elements.");
211     return;
212   }
213
214   Controlador_P.Switch4_Threshold = (real_T) (((real_T *)
215     mxGetData(ssGetSFcnParam(S, 7)))[0]);
216
217   /* Parameter check for 'Matriz_de_filas_2_de_K0_K8_Valu' */
218   if (mxIsComplex(ssGetSFcnParam(S, 8))) {
219     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_2_de_K0_K8_Valu' has to be a non complex type.");
220     return;
221   }
222   if (!mxIsDouble(ssGetSFcnParam(S, 8))) {
223     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_2_de_K0_K8_Valu' has to be a double type.");
224     return;
225   }
226   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 8)) != 2) {
227     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_2_de_K0_K8_Valu' has to have 2 dimensions.");
228     return;
229   }
230   if (mxGetNumberOfElements(ssGetSFcnParam(S, 8)) != 99) {
231     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_2_de_K0_K8_Valu' has to have 99 elements.");
232     return;
```

```
233   }
234
235   for (i=0; i<99; i++) {
236
237     Controlador_P.Matriz_de_filas_2_de_K0_K8_Valu[i] = (real_T) (((real_T *)
238       mxGetData(ssGetSFcnParam(S, 8)))[i]);
239   }
240
241   /* Parameter check for 'Matriz_de_filas_3_de_K0_K1_Valu' */
242   if (mxIsComplex(ssGetSFcnParam(S, 9))) {
243     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_3_de_K0_K1_Valu' has to be a non complex type.");
244     return;
245   }
246   if (!mxIsDouble(ssGetSFcnParam(S, 9))) {
247     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_3_de_K0_K1_Valu' has to be a double type.");
248     return;
249   }
250   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 9)) != 2) {
251     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_3_de_K0_K1_Valu' has to have 2 dimensions.");
252     return;
253   }
254   if (mxGetNumberOfElements(ssGetSFcnParam(S, 9)) != 99) {
255     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_3_de_K0_K1_Valu' has to have 99 elements.");
256     return;
257   }
258
259   for (i=0; i<99; i++) {
260
261     Controlador_P.Matriz_de_filas_3_de_K0_K1_Valu[i] = (real_T) (((real_T *)
262       mxGetData(ssGetSFcnParam(S, 9)))[i]);
263   }
264
265   /* Parameter check for 'Matriz_de_filas_4_de_K0_K2_Valu' */
266   if (mxIsComplex(ssGetSFcnParam(S, 10))) {
267     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_4_de_K0_K2_Valu' has to be a non complex type.");
268     return;
269   }
270   if (!mxIsDouble(ssGetSFcnParam(S, 10))) {
271     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_4_de_K0_K2_Valu' has to be a double type.");
272     return;
273   }
274   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 10)) != 2) {
275     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_4_de_K0_K2_Valu' has to have 2 dimensions.");
276     return;
277   }
278   if (mxGetNumberOfElements(ssGetSFcnParam(S, 10)) != 99) {
279     ssSetErrorStatus(S,"Parameter 'Matriz_de_filas_4_de_K0_K2_Valu' has to have 99 elements.");
280   return;
281   }
282
283   for (i=0; i<99; i++) {
284
285     Controlador_P.Matriz_de_filas_4_de_K0_K2_Valu[i] = (real_T) (((real_T *)
286       mxGetData(ssGetSFcnParam(S, 10)))[i]);
287   }
288
289   /* Parameter check for 'Saturation_UpperSat' */
290   if (mxIsComplex(ssGetSFcnParam(S, 11))) {
291     ssSetErrorStatus(S,"Parameter 'Saturation_UpperSat' has to be a non complex type.");
292     return;
293   }
294   if (!mxIsDouble(ssGetSFcnParam(S, 11))) {
295     ssSetErrorStatus(S,"Parameter 'Saturation_UpperSat' has to be a double type.");
296     return;
297   }
298   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 11)) != 2) {
299     ssSetErrorStatus(S,"Parameter 'Saturation_UpperSat' has to have 2 dimensions.");
300     return;
301   }
302   if (mxGetNumberOfElements(ssGetSFcnParam(S, 11)) != 1) {
303     ssSetErrorStatus(S,"Parameter 'Saturation_UpperSat' has to have 1 elements.");
304     return;
305   }
306
307   Controlador_P.Saturation_UpperSat = (real_T) (((real_T *)
308     mxGetData(ssGetSFcnParam(S, 11)))[0]);
```

```
309
310   /* Parameter check for 'Saturation_LowerSat' */
311   if (mxIsComplex(ssGetSFcnParam(S, 12))) {
312     ssSetErrorStatus(S,"Parameter 'Saturation_LowerSat' has to be a non complex type.");
313     return;
314   }
315   if (!mxIsDouble(ssGetSFcnParam(S, 12))) {
316     ssSetErrorStatus(S,"Parameter 'Saturation_LowerSat' has to be a double type.");
317     return;
318   }
319   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 12)) != 2) {
320     ssSetErrorStatus(S,"Parameter 'Saturation_LowerSat' has to have 2 dimensions.");
321     return;
322   }
323   if (mxGetNumberOfElements(ssGetSFcnParam(S, 12)) != 1) {
324     ssSetErrorStatus(S,"Parameter 'Saturation_LowerSat' has to have 1 elements.");
325     return;
326   }
327
328   Controlador_P.Saturation_LowerSat = (real_T) (((real_T *)
329     mxGetData(ssGetSFcnParam(S, 12)))[0]);
330
331   /* Parameter check for 'Switch_Threshold' */
332   if (mxIsComplex(ssGetSFcnParam(S, 13))) {
333     ssSetErrorStatus(S,"Parameter 'Switch_Threshold' has to be a non complex type.");
334     return;
335   }
336   if (!mxIsDouble(ssGetSFcnParam(S, 13))) {
337     ssSetErrorStatus(S,"Parameter 'Switch_Threshold' has to be a double type.");
338     return;
339   }
340   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 13)) != 2) {
341     ssSetErrorStatus(S,"Parameter 'Switch_Threshold' has to have 2 dimensions.");
342     return;
343   }
344   if (mxGetNumberOfElements(ssGetSFcnParam(S, 13)) != 1) {
345     ssSetErrorStatus(S,"Parameter 'Switch_Threshold' has to have 1 elements.");
346     return;
347   }
348
349   Controlador_P.Switch_Threshold = (real_T) (((real_T *)
350     mxGetData(ssGetSFcnParam(S, 13)))[0]);
351
352   /* Parameter check for 'Switch1_Threshold' */
353   if (mxIsComplex(ssGetSFcnParam(S, 14))) {
354     ssSetErrorStatus(S,"Parameter 'Switch1_Threshold' has to be a non complex type.");
355     return;
356   }
357   if (!mxIsDouble(ssGetSFcnParam(S, 14))) {
358     ssSetErrorStatus(S,"Parameter 'Switch1_Threshold' has to be a double type.");
359     return;
360   }
361   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 14)) != 2) {
362     ssSetErrorStatus(S,"Parameter 'Switch1_Threshold' has to have 2 dimensions.");
363     return;
364   }
365   if (mxGetNumberOfElements(ssGetSFcnParam(S, 14)) != 1) {
366     ssSetErrorStatus(S,"Parameter 'Switch1_Threshold' has to have 1 elements.");
367     return;
368   }
369
370   Controlador_P.Switch1_Threshold = (real_T) (((real_T *)
371     mxGetData(ssGetSFcnParam(S, 14)))[0]);
372
373   /* Parameter check for 'Switch2_Threshold' */
374   if (mxIsComplex(ssGetSFcnParam(S, 15))) {
375     ssSetErrorStatus(S,"Parameter 'Switch2_Threshold' has to be a non complex type.");
376     return;
377   }
378   if (!mxIsDouble(ssGetSFcnParam(S, 15))) {
379     ssSetErrorStatus(S,"Parameter 'Switch2_Threshold' has to be a double type.");
380     return;
381   }
382   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 15)) != 2) {
383     ssSetErrorStatus(S,"Parameter 'Switch2_Threshold' has to have 2 dimensions.");
384     return;
```

```
385   }
386   if (mxGetNumberOfElements(ssGetSFcnParam(S, 15)) != 1) {
387     ssSetErrorStatus(S,"Parameter 'Switch2_Threshold' has to have 1 elements.");
388     return;
389   }
390
391   Controlador_P.Switch2_Threshold = (real_T) (((real_T *)
392     mxGetData(ssGetSFcnParam(S, 15)))[0]);
393
394   /* Parameter check for 'Switch3_Threshold' */
395   if (mxIsComplex(ssGetSFcnParam(S, 16))) {
396     ssSetErrorStatus(S,"Parameter 'Switch3_Threshold' has to be a non complex type.");
397     return;
398   }
399   if (!mxIsDouble(ssGetSFcnParam(S, 16))) {
400     ssSetErrorStatus(S,"Parameter 'Switch3_Threshold' has to be a double type.");
401     return;
402   }
403   if (mxGetNumberOfDimensions(ssGetSFcnParam(S, 16)) != 2) {
404     ssSetErrorStatus(S,"Parameter 'Switch3_Threshold' has to have 2 dimensions.");
405     return;
406   }
407   if (mxGetNumberOfElements(ssGetSFcnParam(S, 16)) != 1) {
408     ssSetErrorStatus(S,"Parameter 'Switch3_Threshold' has to have 1 elements.");
409     return;
410   }
411
412   Controlador_P.Switch3_Threshold = (real_T) (((real_T *)
413     mxGetData(ssGetSFcnParam(S, 16)))[0]);
414 }
415 #endif                          /* MDL_CHECK_PARAMETERS */
416
417 /* Function: mdlInitializeSizes ===============================================
418  * Abstract:
419  *   This function register the input and output signal porperties of the
420  *   generated ERT C-Code.
421  */
422 static void mdlInitializeSizes(SimStruct *S)
423 {
424   /* Tunable Parameters */
425   ssSetNumSFcnParams(S, 17);
426   /* Number of expected parameters */
427   if (ssGetNumSFcnParams(S) == ssGetSFcnParamsCount(S)) {
428 #if defined(MDL_CHECK_PARAMETERS)
429     mdlCheckParameters(S);
430 #endif                          /* MDL_CHECK_PARAMETERS */
431     if (ssGetErrorStatus(S) != NULL) {
432       return;
433     }
434   } else {
435     return;                     /* Parameter mismatch will be reported by Simulink */
436   }
437
438   rtInf = mxGetInf();
439
440   ssSetNumContStates(S, 0);
441   ssSetNumDiscStates(S, 0);
442
443   /* Number of input ports */
444   if (!ssSetNumInputPorts(S, 2)) return;
445
446   if(!ssSetInputPortVectorDimension(S, 0, 11)) return;
447   ssSetInputPortDirectFeedThrough(S, 0, 1);
448   ssSetInputPortSampleTime(S, 0, -1);
449
450   if(!ssSetInputPortVectorDimension(S, 1, 11)) return;
451   ssSetInputPortDirectFeedThrough(S, 1, 1);
452   ssSetInputPortSampleTime(S, 1, -1);
453
454   /* Number of output ports */
455   if (!ssSetNumOutputPorts(S, 1)) return;
456
457   if(!ssSetOutputPortVectorDimension(S, 0, 4)) return;
458   ssSetOutputPortSampleTime(S, 0, -1);
459
460   /* Number of sample-times */
```

```
461   ssSetNumSampleTimes(S, 1);
462   ssSetNumRWork(S, 0);
463   ssSetNumIWork(S, 0);
464   ssSetNumPWork(S, 0);
465   ssSetNumModes(S, 0);
466   ssSetNumNonsampledZCs(S, 0);
467
468   /* exception free code */
469   ssSetOptions(S, SS_OPTION_EXCEPTION_FREE_CODE);
470
471   /* input and output ports are already assigned */
472   /* ssSetOptions(S, SS_OPTION_PORT_SAMPLE_TIMES_ASSIGNED); */
473 }
474
475 /* Function: mdlInitializeSizes ===============================================
476  * Abstract:
477  *    This function register the sample times of the generated ERT C-Code.
478  */
479 static void mdlInitializeSampleTimes(SimStruct *S)
480 {
481   ssSetSampleTime(S, 0, -1);
482 }
483
484 #define MDL_INITIALIZE_CONDITIONS
485 /* Function: mdlInitializeConditions ========================================
486  * Abstract:
487  *   This function calls the initialization function of the generated ERT-
488  *   C-Code.
489  */
490 static void mdlInitializeConditions(SimStruct *S)
491 {
492
493 #ifdef PIL_S_FUNCTION
494   pilMarshallInitSFcnSimStruct(S);
495   pilMarshallInitRootSimStruct(ssGetRootSS(S));
496 #endif
497
498   Controlador_initialize(1);
499 }
500
501 #define MDL_START                                 /* Change to #undef to remove function */
502 #if defined(MDL_START)
503 /* Function: mdlStart =======================================================
504  * Abstract:
505  *
506  */
507 static void mdlStart(SimStruct *S)
508 {
509   /* check if more than one instances of this s-function is been used */
510   if (++Controlador_sf_counter > 1) {
511     ssSetErrorStatus(S,"This S-Function is limited to one copy per model.");
512     Controlador_sf_counter = 0;
513     return;
514   }
515 }
516 #endif                          /*  MDL_START */
517
518 /* Function: mdlOutputs =======================================================
519  * Abstract:
520  *   This function calls the majorstep function of the generated ERT C-Code,
521  *   and serves the interface which the needed simulation data.
522  */
523 static void mdlOutputs(SimStruct *S, int_T tid)
524 {
525   InputRealPtrsType InPort_0 = (InputRealPtrsType) ssGetInputPortSignalPtrs(S,
526     0);
527   InputRealPtrsType InPort_1 = (InputRealPtrsType) ssGetInputPortSignalPtrs(S,
528     1);
529
530   real_T *OutPort_0 = ssGetOutputPortSignal(S, 0);
531
532   {
533     int i = 0;
534     for(i = 0; i < 11; i++) {
535       Controlador_U.In_error[i] = InPort_0[i][0];
536     }
```

```
  }
  {
    int i = 0;
    for(i = 0; i < 11; i++) {
      Controlador_U.In_estado[i] = InPort_1[i][0];
    }
  }

  Controlador_step();

  {
    int i = 0;
    for(i = 0; i < 4; i++) {
      OutPort_0[i] = Controlador_Y.Out_actuaci_n[i];
    }
  }
}

/* Function: mdlTerminate =====================================================
 * Abstract:
 *   This function calls the termination function of the generated ERT-C-Code.
 */
static void mdlTerminate(SimStruct *S)
{

  Controlador_terminate();
  Controlador_sf_counter = 0;
}

#ifdef MATLAB_MEX_FILE          /* Is this file being compiled as a MEX-file? */
#include "simulink.c"           /* MEX-file interface mechanism */
#else
#include "cg_sfun.h"            /* Code generation registration function */
#endif
```

6.3.2.5 Código Fuente de “primerNoNulo.c”.

```
/*
 * File: primerNoNulo.c
 *
 *
 *
 *   --- THIS FILE GENERATED BY S-FUNCTION BUILDER: 2.0 ---
 *
 *   This file is an S-function produced by the S-Function
 *   Builder which only recognizes certain fields.  Changes made
 *   outside these fields will be lost the next time the block is
 *   used to load, edit, and resave this file. This file will be overwritten
 *   by the S-function Builder block. If you want to edit this file by hand,
 *   you must change it only in the area defined as:
 *
 *       %%%-SFUNWIZ_defines_Changes_BEGIN
 *       #define NAME 'replacement text'
 *       %%% SFUNWIZ_defines_Changes_END
 *
 *   DO NOT change NAME--Change the 'replacement text' only.
 *
 *   For better compatibility with the Real-Time Workshop, the
 *   "wrapper" S-function technique is used.  This is discussed
 *   in the Real-Time Workshop User's Manual in the Chapter titled,
 *   "Wrapper S-functions".
 *
 *  ------------------------------------------------------------------------
 * | See matlabroot/simulink/src/sfuntmpl_doc.c for a more detailed template |
 *  ------------------------------------------------------------------------
 * Created: Tue Sep 16 18:04:22 2003
 *
 *
 */


#define S_FUNCTION_NAME primerNoNulo
#define S_FUNCTION_LEVEL 2
/*<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<*/
```

```
/* %%%-SFUNWIZ_defines_Changes_BEGIN --- EDIT HERE TO _END */
#define NUM_INPUTS          1
/* Input Port  0 */
#define IN_PORT_0_NAME      u0
#define INPUT_0_WIDTH       4
#define INPUT_DIMS_0_COL    1
#define INPUT_0_DTYPE       boolean_T
#define INPUT_0_COMPLEX     COMPLEX_NO
#define IN_0_FRAME_BASED    FRAME_NO
#define IN_0_DIMS           1-D
#define INPUT_0_FEEDTHROUGH 1

#define NUM_OUTPUTS         1
/* Output Port  0 */
#define OUT_PORT_0_NAME     y0
#define OUTPUT_0_WIDTH      1
#define OUTPUT_DIMS_0_COL   1
#define OUTPUT_0_DTYPE      real_T
#define OUTPUT_0_COMPLEX    COMPLEX_NO
#define OUT_0_FRAME_BASED   FRAME_NO
#define OUT_0_DIMS          1-D

#define NPARAMS             0

#define SAMPLE_TIME_0       INHERITED_SAMPLE_TIME
#define NUM_DISC_STATES     0
#define DISC_STATES_IC      [0]
#define NUM_CONT_STATES     0
#define CONT_STATES_IC      [0]

#define SFUNWIZ_GENERATE_TLC 1
#define SOURCEFILES ""
#define PANELINDEX          6
#define SFUNWIZ_REVISION    2.0
/* %%%-SFUNWIZ_defines_Changes_END --- EDIT HERE TO _BEGIN */
/*<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<*/
#include "simstruc.h"


extern void primerNoNulo_Outputs_wrapper(const boolean_T *u0,
                real_T *y0);
extern void primerNoNulo_Update_wrapper(const boolean_T *u0,
                const real_T *y0 );
extern void primerNoNulo_Derivatives_wrapper(const boolean_T *u0,
                const real_T *y0,
                real_T *dx );


/*====================*
 * S-function methods *
 *====================*/


/* Function: mdlInitializeSizes ===============================================
 * Abstract:
 *   Setup sizes of the various vectors.
 */
static void mdlInitializeSizes(SimStruct *S)
{

    DECL_AND_INIT_DIMSINFO(inputDimsInfo);
    DECL_AND_INIT_DIMSINFO(outputDimsInfo);
    ssSetNumSFcnParams(S, NPARAMS);
    if (ssGetNumSFcnParams(S) != ssGetSFcnParamsCount(S)) {
        return; /* Parameter mismatch will be reported by Simulink */
    }

    ssSetNumContStates(S, NUM_CONT_STATES);
    ssSetNumDiscStates(S, NUM_DISC_STATES);

    if (!ssSetNumInputPorts(S, NUM_INPUTS)) return;
    inputDimsInfo.width = INPUT_0_WIDTH;
    ssSetInputPortDimensionInfo(S, 0, &inputDimsInfo);
    ssSetInputPortFrameData(S, 0, IN_0_FRAME_BASED);
    ssSetInputPortDataType(S, 0, SS_BOOLEAN);
    ssSetInputPortComplexSignal(S, 0, INPUT_0_COMPLEX);
```

```
    ssSetInputPortDirectFeedThrough(S, 0, INPUT_0_FEEDTHROUGH);
    ssSetInputPortRequiredContiguous(S, 0, 1); /*direct input signal access*/

    if (!ssSetNumOutputPorts(S, NUM_OUTPUTS)) return;
    outputDimsInfo.width = OUTPUT_0_WIDTH;
    ssSetOutputPortDimensionInfo(S, 0, &outputDimsInfo);
    ssSetOutputPortFrameData(S, 0, OUT_0_FRAME_BASED);
    ssSetOutputPortDataType(S, 0, SS_DOUBLE);
    ssSetOutputPortComplexSignal(S, 0, OUTPUT_0_COMPLEX);
    ssSetNumSampleTimes(S, 1);
    ssSetNumRWork(S, 0);
    ssSetNumIWork(S, 0);
    ssSetNumPWork(S, 0);
    ssSetNumModes(S, 0);
    ssSetNumNonsampledZCs(S, 0);

    /* Take care when specifying exception free code - see sfuntmpl_doc.c */
    ssSetOptions(S, (SS_OPTION_EXCEPTION_FREE_CODE |
                     SS_OPTION_USE_TLC_WITH_ACCELERATOR |
                         SS_OPTION_WORKS_WITH_CODE_REUSE));
}


#define MDL_SET_INPUT_PORT_DIMENSION_INFO
void mdlSetInputPortDimensionInfo(SimStruct        *S,
                          int              portIndex,
                          const DimsInfo_T *dimsInfo)
{
  DECL_AND_INIT_DIMSINFO(portDimsInfo);
  int_T dims[2] = { OUTPUT_0_WIDTH, 1 };
  bool  frameIn = (ssGetInputPortFrameData(S, 0) == FRAME_YES);

  ssSetInputPortDimensionInfo(S, 0, dimsInfo);

  if (ssGetOutputPortNumDimensions(S, 0) == (-1)) {
     /* the output port has not been set */

     portDimsInfo.width   = OUTPUT_0_WIDTH;
     portDimsInfo.numDims = frameIn ? 2 : 1;
     portDimsInfo.dims    = frameIn ? dims : &portDimsInfo.width;

     ssSetOutputPortDimensionInfo(S, 0, &portDimsInfo);
  }
}


#define MDL_SET_OUTPUT_PORT_DIMENSION_INFO
void mdlSetOutputPortDimensionInfo(SimStruct        *S,
                           int_T            portIndex,
                           const DimsInfo_T *dimsInfo)
{
  DECL_AND_INIT_DIMSINFO(portDimsInfo);
  int_T dims[2] = { OUTPUT_0_WIDTH, 1 };
  bool  frameOut = (ssGetOutputPortFrameData(S, 0) == FRAME_YES);

  ssSetOutputPortDimensionInfo(S, 0, dimsInfo);

  if (ssGetInputPortNumDimensions(S, 0) == (-1)) {
     /* the input port has not been set */

     portDimsInfo.width   = INPUT_0_WIDTH;
     portDimsInfo.numDims = frameOut ? 2 : 1;
     portDimsInfo.dims    = frameOut ? dims : &portDimsInfo.width;

     ssSetInputPortDimensionInfo(S, 0, &portDimsInfo);
  }
}


#define MDL_SET_DEFAULT_PORT_DIMENSION_INFO
static void mdlSetDefaultPortDimensionInfo(SimStruct *S)
{
  DECL_AND_INIT_DIMSINFO(portDimsInfo);
  int_T dims[2] = { INPUT_0_WIDTH, 1 };
  bool  frameIn = ssGetInputPortFrameData(S, 0) == FRAME_YES;
```

```
  /* Neither the input nor the output ports have been set */

  portDimsInfo.width   = INPUT_0_WIDTH;
  portDimsInfo.numDims = frameIn ? 2 : 1;
  portDimsInfo.dims    = frameIn ? dims : &portDimsInfo.width;
  if (ssGetInputPortNumDimensions(S, 0) == (-1)) {
   ssSetInputPortDimensionInfo(S, 0, &portDimsInfo);
  }
  portDimsInfo.width   = OUTPUT_0_WIDTH;
  dims[0]              = OUTPUT_0_WIDTH;
 if (ssGetOutputPortNumDimensions(S, 0) == (-1)) {
  ssSetOutputPortDimensionInfo(S, 0, &portDimsInfo);
 }
  return;
}
# define MDL_SET_INPUT_PORT_FRAME_DATA
static void mdlSetInputPortFrameData(SimStruct  *S,
                                     int_T      port,
                                     Frame_T    frameData)
{
   ssSetInputPortFrameData(S, port, frameData);
}
/* Function: mdlInitializeSampleTimes =========================================
 * Abstract:
 *    Specifiy  the sample time.
 */
static void mdlInitializeSampleTimes(SimStruct *S)
{
   ssSetSampleTime(S, 0, SAMPLE_TIME_0);    ssSetOffsetTime(S, 0, 0.0);
}

#define MDL_SET_INPUT_PORT_DATA_TYPE
static void mdlSetInputPortDataType(SimStruct *S, int port, DTypeId dType)
{
   ssSetInputPortDataType( S, 0, dType);
}

#define MDL_SET_OUTPUT_PORT_DATA_TYPE
static void mdlSetOutputPortDataType(SimStruct *S, int port, DTypeId dType)
{
   ssSetOutputPortDataType(S, 0, dType);
}

#define MDL_SET_DEFAULT_PORT_DATA_TYPES
static void mdlSetDefaultPortDataTypes(SimStruct *S)
{
 ssSetInputPortDataType( S, 0, SS_DOUBLE);
 ssSetOutputPortDataType(S, 0, SS_DOUBLE);
}
/* Function: mdlOutputs =======================================================
 *
*/
static void mdlOutputs(SimStruct *S, int_T tid)
{
   const boolean_T  *u0  = (const boolean_T*) ssGetInputPortSignal(S,0);
   real_T        *y0  = (real_T *)ssGetOutputPortRealSignal(S,0);

   primerNoNulo_Outputs_wrapper(u0,y0);
}

#undef MDL_UPDATE  /* Change to #define to use the function */
#if defined(MDL_UPDATE)
  /* Function: mdlUpdate ======================================================
   * Abstract:
   *    This function is called once for every major integration time step.
   *    Discrete states are typically updated here, but this function is useful
   *    for performing any tasks that should only take place once per
   *    integration step.
   */
  static void mdlUpdate(SimStruct *S, int_T tid)
  {
   const boolean_T  *u0  = (const boolean_T*) ssGetInputPortSignal(S,0);
   real_T          *xD  = ssGetDiscStates(S);
   real_T        *y0  = (real_T *)ssGetOutputPortRealSignal(S,0);

   primerNoNulo_Update_wrapper(u0,y0);
```

```
  }
#endif /* MDL_UPDATE */


#undef MDL_DERIVATIVES  /* Change to #define to use function */
#if defined(MDL_DERIVATIVES)
  /* Function: mdlDerivatives =============================================
   * Abstract:
   *    In this function, you compute the S-function block's derivatives.
   *    The derivatives are placed in the derivative vector, ssGetdX(S).
   */
  static void mdlDerivatives(SimStruct *S)
  {
    const boolean_T  *u0  = (const boolean_T*) ssGetInputPortSignal(S,0);
    real_T         *dx  = ssGetdX(S);
    real_T         *xC  = ssGetContStates(S);
    real_T        *y0  = (real_T *) ssGetOutputPortRealSignal(S,0);

    primerNoNulo_Derivatives_wrapper(u0,y0, dx);
  }
#endif /* MDL_DERIVATIVES */



/* Function: mdlTerminate =============================================
 * Abstract:
 *    No termination needed, but we are required to have this routine.
 */
static void mdlTerminate(SimStruct *S)
{
}



#ifdef  MATLAB_MEX_FILE    /* Is this file being compiled as a MEX-file? */
#include "simulink.c"      /* MEX-file interface mechanism */
#else
#include "cg_sfun.h"       /* Code generation registration function */
#endif
```

6.3.2.6 Código Fuente de “primerNoNulo_wrapper.c”.

```
/*
 *
 *   --- THIS FILE GENERATED BY S-FUNCTION BUILDER: 2.0 ---
 *
 *   This file is a wrapper S-function produced by the S-Function
 *   Builder which only recognizes certain fields.  Changes made
 *   outside these fields will be lost the next time the block is
 *   used to load, edit, and resave this file. This file will be overwritten
 *   by the S-function Builder block. If you want to edit this file by hand,
 *   you must change it only in the area defined as:
 *
 *       %%%-SFUNWIZ_wrapper_XXXXX_Changes_BEGIN
 *           Your Changes go here
 *       %%%-SFUNWIZ_wrapper_XXXXXX_Changes_END
 *
 *   For better compatibility with the Real-Time Workshop, the
 *   "wrapper" S-function technique is used.  This is discussed
 *   in the Real-Time Workshop User's Manual in the Chapter titled,
 *   "Wrapper S-functions".
 *
 *   Created: Tue Sep 16 18:04:22 2003
 */


/*
 * Include Files
 *
 */
#include "tmwtypes.h"
/* %%%-SFUNWIZ_wrapper_includes_Changes_BEGIN --- EDIT HERE TO _END */
#include <math.h>
#include <stdlib.h>
/* %%%-SFUNWIZ_wrapper_includes_Changes_END --- EDIT HERE TO _BEGIN */
```

```
#define u_width 4
#define y_width 1
/*
 * Create external references here.
 *
 */
/* %%%-SFUNWIZ_wrapper_externs_Changes_BEGIN --- EDIT HERE TO _END */
/* extern double func(double a); */
extern double* primerNoNulo(int* u0);
/* %%%-SFUNWIZ_wrapper_externs_Changes_END --- EDIT HERE TO _BEGIN */

/*
 * Output functions
 *
 */
void primerNoNulo_Outputs_wrapper(const boolean_T *u0,
                        real_T *y0)
{
/* %%%-SFUNWIZ_wrapper_Outputs_Changes_BEGIN --- EDIT HERE TO _END */
/* This sample sets the output equal to the input
        y0[0] = u0[0];
 For complex signals use: y0[0].re = u0[0].re;
                        y0[0].im = u0[0].im;
                        y1[0].re = u1[0].re;
                        y1[0].im = u1[0].im;*/
 {
                int k=0;
                int flag=0;
                while(k<4 && flag==0)
                {
                        if(u0[k]!=0) flag = 1;
                        k++;
                }
                *y0=k-1;
 }
/* %%%-SFUNWIZ_wrapper_Outputs_Changes_END --- EDIT HERE TO _BEGIN */
}

/*
 * Updates function
 *
 */
void primerNoNulo_Update_wrapper(const boolean_T *u0,
                        const real_T *y0 )
{
/* %%%-SFUNWIZ_wrapper_Update_Changes_BEGIN --- EDIT HERE TO _END */
/*
  * Code example
  *   xD[0] = u0[0];
  */
/* %%%-SFUNWIZ_wrapper_Update_Changes_END --- EDIT HERE TO _BEGIN */
}

/*
 *  Derivatives function
 *
 */
void primerNoNulo_Derivatives_wrapper(const boolean_T *u0,
                        const real_T *y0,
                        real_T *dx )
{
/* %%%-SFUNWIZ_wrapper_Derivatives_Changes_BEGIN --- EDIT HERE TO _END */
/*
  * Code example
  *   dx[0] = xC[0];
  */
/* %%%-SFUNWIZ_wrapper_Derivatives_Changes_END --- EDIT HERE TO _BEGIN */
}
```

6.3.2.7 Código Fuente de “Controlador.h”.

```
1  /*
2   * Controlador.h
3   *
4   * Real-Time Workshop code generation for Simulink model "Controlador.mdl".
```

```
 5  *
 6  * Model Version                  : 1.3
 7  * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
 8  * Real-Time Workshop file generated on : Tue Sep 23 20:35:03 2003
 9  * TLC version                   : 5.0 (Jun 18 2002)
10   * C source code generated on          : Tue Sep 23 20:35:05 2003
11   */
12
13  #ifndef _RTW_HEADER_Controlador_h_
14  # define _RTW_HEADER_Controlador_h_
15
16  #ifndef _Controlador_COMMON_INCLUDES_
17  # define _Controlador_COMMON_INCLUDES_
18  #include <math.h>
19  #include <float.h>
20  #include <string.h>
21
22  #include "tmwtypes.h"
23  #include "simstruc_types.h"
24  #include "rtlibsrc.h"
25
26  #endif                             /* _Controlador_COMMON_INCLUDES_ */
27
28  #include "Controlador_types.h"
29
30  /* Intrinsic types */
31  #ifndef POINTER_T
32  # define POINTER_T
33  typedef void * pointer_T;
34  #endif
35
36  /* Block signals (auto storage) */
37  typedef struct _BlockIO_Controlador {
38    real_T S_Function;                /* '<S1>/S-Function' */
39    boolean_T Igualdad[4];              /* '<S1>/Igualdad' */
40  } BlockIO_Controlador;
41
42  /* Block states (auto storage) for system: '<Root>' */
43  typedef struct D_Work_Controlador_tag {
44    int32_T Selector_DWORK2;            /* <Root>/Selector */
45    int32_T Selector1_DWORK2;           /* <Root>/Selector1 */
46    int32_T Selector2_DWORK2;           /* <Root>/Selector2 */
47    int32_T Selector3_DWORK2;           /* <Root>/Selector3 */
48  } D_Work_Controlador;
49
50  /* Parameters (auto storage) */
51  struct _Parameters_Controlador {
52    real_T Matriz_de_filas_1_de_K0_K8_Valu[99]; /* Expression: M1
53                                     * '<Root>/Matriz de filas 1 de K0,...,K8'
54                                     */
55    real_T Constant_Value[4];           /* Expression: [1,1,1,1]'
56                                     * '<S1>/Constant'
57                                     */
58    real_T Gain_Gain;                   /* Expression: 0.1965
59                                     * '<S1>/Gain'
60                                     */
61    real_T Gain1_Gain;                  /* Expression: 0.1965
62                                     * '<S1>/Gain1'
63                                     */
64    real_T Gain2_Gain;                  /* Expression: 0.1965
65                                     * '<S1>/Gain2'
66                                     */
67    real_T Gain3_Gain;                  /* Expression: 0.9549
68                                     * '<S1>/Gain3'
69                                     */
70    real_T Movimiento_Tipo_Value[9];    /* Expression: [1,2,3,4,5,6,7,8,9]'
71                                     * '<S1>/Movimiento Tipo'
72                                     */
73    real_T Switch4_Threshold;           /* Expression: 0.25
74                                     * '<S1>/Switch4'
75                                     */
76    real_T Matriz_de_filas_2_de_K0_K8_Valu[99]; /* Expression: M2
77                                     * '<Root>/Matriz de filas 2 de K0,...,K8'
78                                     */
79    real_T Matriz_de_filas_3_de_K0_K1_Valu[99]; /* Expression: M3
80                                     * '<Root>/Matriz de filas 3 de K0,...,K1'
```

```
81                                      */
82    real_T Matriz_de_filas_4_de_K0_K2_Valu[99]; /* Expression: M4
83                                      * '<Root>/Matriz de filas 4 de K0,...,K2'
84                                      */
85    real_T Saturation_UpperSat;           /* Expression: 1
86                                    * '<Root>/Saturation'
87                                    */
88    real_T Saturation_LowerSat;           /* Expression: -1
89                                    * '<Root>/Saturation'
90                                    */
91    real_T Switch_Threshold;              /* Expression: 0
92                                    * '<S1>/Switch'
93                                    */
94    real_T Switch1_Threshold;             /* Expression: 0
95                                    * '<S1>/Switch1'
96                                    */
97    real_T Switch2_Threshold;             /* Expression: 0
98                                    * '<S1>/Switch2'
99                                    */
100    real_T Switch3_Threshold;             /* Expression: 0
101                                     * '<S1>/Switch3'
102                                     */
103   };
104
105   /* External inputs (root inport signals with auto storage) */
106   typedef struct _ExternalInputs_Controlador_tag {
107     real_T In_error[11];                /* '<Root>/In: error' */
108     real_T In_estado[11];               /* '<Root>/In: estado' */
109   } ExternalInputs_Controlador;
110
111   /* External outputs (root outports fed by signals with auto storage) */
112   typedef struct _ExternalOutputs_Controlador_tag {
113     real_T Out_actuaci_n[4];            /* '<Root>/Out: actuación' */
114   } ExternalOutputs_Controlador;
115
116   /* Real-time Model Data Structure */
117   struct _RT_MODEL_Controlador_Tag {
118     const char *errorStatus;
119   };
120
121   /* Real-time Model object */
122   extern RT_MODEL_Controlador *Controlador_M;
123
124   /* Macros for accessing real-time model data structure  */
125
126   #ifndef rtmGetErrorStatus
127   # define rtmGetErrorStatus(rtm) (rtm)->errorStatus
128   #endif
129
130   #ifndef rtmSetErrorStatus
131   # define rtmSetErrorStatus(rtm, val) (rtm)->errorStatus = ((val))
132   #endif
133
134   #ifndef rtmGetTStart
135   # define rtmGetTStart(rtm) (0.0)
136   #endif
137
138   /* Backward compatibility for real-time model name change */
139   #define Controlador_rtO               Controlador_M
140   #define Controlador_RT_OBJECT         RT_MODEL_Controlador
141
142   /* Block parameters (auto storage) */
143   extern Parameters_Controlador Controlador_P;
144
145   /* Block signals (auto storage) */
146   extern BlockIO_Controlador Controlador_B;
147
148   /* Block states (auto storage) */
149   extern D_Work_Controlador Controlador_DWork;
150
151   /* External inputs (root inport signals with auto storage) */
152   extern ExternalInputs_Controlador Controlador_U;
153
154   /* External outputs (root outports fed by signals with auto storage) */
155   extern ExternalOutputs_Controlador Controlador_Y;
156
```

```
157  /* Model entry point functions */
158  extern void Controlador_initialize(boolean_T firstTime);
159  extern void Controlador_step(void);
160  extern void Controlador_terminate(void);
161
162  /*
163   * The generated code includes comments that allow you to trace directly
164   * back to the appropriate location in the model.  The basic format
165   * is <system>/block_name, where system is the system number (uniquely
166   * assigned by Simulink) and block_name is the name of the block.
167   *
168   * Use the MATLAB hilite_system command to trace the generated code back
169   * to the model.  For example,
170   *
171   * hilite_system('<S3>')    - opens system 3
172   * hilite_system('<S3>/Kp') - opens and selects block Kp which resides in S3
173   *
174   * Here is the system hierarchy for this model
175   *
176   * '<Root>' : Controlador
177   * '<S1>'   : Controlador/Método de Ajuste: Decisor
178   */
179
180  #endif                                 /* _RTW_HEADER_Controlador_h_ */
```

6.3.2.8 Código Fuente de “Controlador_private.h”.

```
1   /*
2    * Controlador_private.h
3    *
4    * Real-Time Workshop code generation for Simulink model "Controlador.mdl".
5    *
6    * Model Version                        : 1.3
7    * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
8    * Real-Time Workshop file generated on : Tue Sep 23 20:35:03 2003
9    * TLC version                          : 5.0 (Jun 18 2002)
10    * C source code generated on          : Tue Sep 23 20:35:05 2003
11    */
12
13   #ifndef _RTW_HEADER_Controlador_private_h_
14   # define _RTW_HEADER_Controlador_private_h_
15
16   /* Private Macros used by the generated code to access rtModel */
17
18   #ifndef rtmIsMajorTimeStep
19   # define rtmIsMajorTimeStep(rtm) (1)
20   #endif
21
22   #ifndef rtmIsMinorTimeStep
23   # define rtmIsMinorTimeStep(rtm) (0)
24   #endif
25
26   #ifndef _RTW_COMMON_DEFINES_
27   # define _RTW_COMMON_DEFINES_
28
29   #ifndef TRUE
30   # define TRUE (1)
31   #endif
32   #ifndef FALSE
33   # define FALSE (0)
34   #endif
35   #endif                                 /* _RTW_COMMON_DEFINES_ */
36
37   #ifndef UCHAR_MAX
38   #include <limits.h>
39   #endif
40
41   #if ( UCHAR_MAX != (0xFFU) )
42   #error Fixed point code was generated for compiler with different sized uchars.
43   #endif
44
45   #if ( SCHAR_MAX != (0x7F) )
46   #error Fixed point code was generated for compiler with different sized chars.
47   #endif
48
```

```
49  # endif
48
49  #if ( USHRT_MAX != (0xFFFFU) )
50  #error Fixed point code was generated for compiler with different sized ushorts.
51  #endif
52
53  #if ( SHRT_MAX != (0x7FFF) )
54  #error Fixed point code was generated for compiler with different sized shorts.
55  #endif
56
57  #if ( UINT_MAX != (0xFFFFFFFFU) )
58  #error Fixed point code was generated for compiler with different sized uints.
59  #endif
60
61  #if ( INT_MAX != (0x7FFFFFF) )
62  #error Fixed point code was generated for compiler with different sized ints.
63  #endif
64
65  #if ( ULONG_MAX != (0xFFFFFFFFU) )
66  #error Fixed point code was generated for compiler with different sized ulongs.
67  #endif
68
69  #if ( LONG_MAX != (0x7FFFFFF) )
70  #error Fixed point code was generated for compiler with different sized longs.
71  #endif
72
73  extern void primerNoNulo_Outputs_wrapper(const boolean_T *u0,
74   real_T *y0);
75
76  #endif                         /* _RTW_HEADER_Controlador_private_h_ */
```

6.3.2.9 Código Fuente de “Controlador_types.h”.

```
1   /*
2    * Controlador_types.h
3    *
4    * Real-Time Workshop code generation for Simulink model "Controlador.mdl".
5    *
6    * Model Version                  : 1.3
7    * Real-Time Workshop file version      : 5.0 $Date: 2002/05/30 19:21:33 $
8    * Real-Time Workshop file generated on : Tue Sep 23 20:35:03 2003
9    * TLC version                   : 5.0 (Jun 18 2002)
10    * C source code generated on          : Tue Sep 23 20:35:05 2003
11    */
12
13  #ifndef _RTW_HEADER_Controlador_types_h_
14  # define _RTW_HEADER_Controlador_types_h_
15
16  /* Parameters (auto storage) */
17  typedef struct _Parameters_Controlador Parameters_Controlador;
18
19  /* Forward declaration for rtModel */
20  typedef struct _RT_MODEL_Controlador_Tag RT_MODEL_Controlador;
21
22  #endif                         /* _RTW_HEADER_Controlador_types_h_ */
```

6.4 Proyectos XML.

En este anexo se mostrará el conjunto de diferencias existentes entre un proyecto *XML* diseñado para el sistema objetivo *555 Phytec Debug Versión* y otro, para el sistema *DebugRel*. El primero de ellos sirve de base para trabajar con el sistema de evaluación de *Motorola* denominado *MPC555DK*; el segundo, para el *kit* de evaluación de *ATMEL* basado en el microcontrolador *ARM7TDMI*. Para ello se utilizarán dos ejemplos: el primero resulta de la invocación de *RTW* usando la interfaz definida por *Motorola*; el segundo, haciendo uso de la misma interfaz, pero haciendo uso de los archivos modificados dentro de dicha interfaz.

6.4.1 ControladorEXT.xml.

Primero veamos un ejemplo de proyecto *XML* desarrollado por la interfaz de *Motorola* para su modo de funcionamiento denominado *Export Algorithm*, el cual es denotado por *EXP*. Sea:

```
<?xml version="1.0"?>
<?codewarrior exportversion="1.0" ideversion="4.2"?>
<!DOCTYPE PROJECT [

<!ELEMENT PROJECT (TARGETLIST, TARGETORDER, GROUPLIST, DESIGNLIST?)>
<!ELEMENT TARGETLIST (TARGET+)>
<!ELEMENT TARGET (NAME, SETTINGLIST, FILELIST?, LINKORDER?, SEGMENTLIST?, OVERLAYGROUPLIST?,
SUBTARGETLIST?, SUBPROJECTLIST?)>
<!ELEMENT NAME (#PCDATA)>
<!ELEMENT USERSOURCETREETYPE (#PCDATA)>
<!ELEMENT PATH (#PCDATA)>
<!ELEMENT FILELIST (FILE*)>
<!ELEMENT FILE (PATHTYPE, PATHROOT?, ACCESSPATH?, PATH, PATHFORMAT?, ROOTFILEREF?, FILEKIND?,
FILEFLAGS?)>
<!ELEMENT PATHTYPE (#PCDATA)>
<!ELEMENT PATHROOT (#PCDATA)>
<!ELEMENT ACCESSPATH (#PCDATA)>
<!ELEMENT PATHFORMAT (#PCDATA)>
<!ELEMENT ROOTFILEREF (PATHTYPE, PATHROOT?, ACCESSPATH?, PATH, PATHFORMAT?)>
<!ELEMENT FILEKIND (#PCDATA)>
<!ELEMENT FILEFLAGS (#PCDATA)>
<!ELEMENT FILEREF (TARGETNAME?, PATHTYPE, PATHROOT?, ACCESSPATH?, PATH, PATHFORMAT?)>
<!ELEMENT TARGETNAME (#PCDATA)>
<!ELEMENT SETTINGLIST ((SETTING|PANELDATA)+)>
<!ELEMENT SETTING (NAME?, (VALUE|(SETTING+)))>
<!ELEMENT PANELDATA (NAME, VALUE)>
<!ELEMENT VALUE (#PCDATA)>
<!ELEMENT LINKORDER (FILEREF*)>
<!ELEMENT SEGMENTLIST (SEGMENT+)>
<!ELEMENT SEGMENT (NAME, ATTRIBUTES?, FILEREF*)>
<!ELEMENT ATTRIBUTES (#PCDATA)>
<!ELEMENT OVERLAYGROUPLIST (OVERLAYGROUP+)>
<!ELEMENT OVERLAYGROUP (NAME, BASEADDRESS, OVERLAY*)>
<!ELEMENT BASEADDRESS (#PCDATA)>
<!ELEMENT OVERLAY (NAME, FILEREF*)>
<!ELEMENT SUBTARGETLIST (SUBTARGET+)>
<!ELEMENT SUBTARGET (TARGETNAME, ATTRIBUTES?)>
<!ELEMENT SUBPROJECTLIST (SUBPROJECT+)>
<!ELEMENT SUBPROJECT (FILEREF, SUBPROJECTTARGETLIST)>
<!ELEMENT SUBPROJECTTARGETLIST (SUBPROJECTTARGET*)>
<!ELEMENT SUBPROJECTTARGET (TARGETNAME, ATTRIBUTES?)>
<!ELEMENT TARGETORDER (ORDEREDTARGET|ORDEREDDESIGN)*>
<!ELEMENT ORDEREDTARGET (NAME)>
<!ELEMENT ORDEREDDESIGN (NAME, ORDEREDTARGET+)>
<!ELEMENT GROUPLIST (GROUP|FILEREF)*>
```

```
<!ELEMENT GROUP (NAME, (GROUP|FILEREF)*)>
<!ELEMENT DESIGNLIST (DESIGN+)>
<!ELEMENT DESIGN (NAME, DESIGNDATA)>
<!ELEMENT DESIGNDATA (#PCDATA)>
]>
<PROJECT>
  <TARGETLIST>
    <TARGET>
      <NAME>555 Phytec Debug Version</NAME>
      <SETTINGLIST>

        <!-- Settings for "Source Trees" panel -->
        <SETTING><NAME>UserSourceTrees</NAME><VALUE></VALUE></SETTING>

        <!-- Settings for "Custom Keywords" panel -->
        <SETTING><NAME>CustomColor1</NAME>
          <SETTING><NAME>Red</NAME><VALUE>0</VALUE></SETTING>
          <SETTING><NAME>Green</NAME><VALUE>32767</VALUE></SETTING>
          <SETTING><NAME>Blue</NAME><VALUE>0</VALUE></SETTING>
        </SETTING>
        <SETTING><NAME>CustomColor2</NAME>
          <SETTING><NAME>Red</NAME><VALUE>0</VALUE></SETTING>
          <SETTING><NAME>Green</NAME><VALUE>32767</VALUE></SETTING>
          <SETTING><NAME>Blue</NAME><VALUE>0</VALUE></SETTING>
        </SETTING>
        <SETTING><NAME>CustomColor3</NAME>
          <SETTING><NAME>Red</NAME><VALUE>0</VALUE></SETTING>
          <SETTING><NAME>Green</NAME><VALUE>32767</VALUE></SETTING>
          <SETTING><NAME>Blue</NAME><VALUE>0</VALUE></SETTING>
        </SETTING>
        <SETTING><NAME>CustomColor4</NAME>
          <SETTING><NAME>Red</NAME><VALUE>0</VALUE></SETTING>
          <SETTING><NAME>Green</NAME><VALUE>32767</VALUE></SETTING>
          <SETTING><NAME>Blue</NAME><VALUE>0</VALUE></SETTING>
        </SETTING>

        <!-- Settings for "Debugger EPPC Target" panel -->
        <SETTING><NAME>MWDebugger_EPPC_target</NAME><VALUE>Mot555</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_protocol</NAME><VALUE>MSIBDM</VALUE></SETTING>
        <SETTING><NAME>Connection</NAME><VALUE>SerialConnection</VALUE></SETTING>
        <SETTING><NAME>UseInitFile</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_parallel</NAME><VALUE>LPTP1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_hostname</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_logdata</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_breaktype</NAME><VALUE>Software</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_watchtype</NAME><VALUE>DataChanges</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_amcTapForceShell</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_amcTapVerifyMemWrites</NAME><VALUE>0</VALUE></SETTING>
<SETTING><NAME>MWDebugger_EPPC_amcCodeTapSerializeInstExec</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_polltime</NAME><VALUE>500</VALUE></SETTING>
<SETTING><NAME>MWDebugger_EPPC_amcPowerTapMemRdDelay</NAME><VALUE>350</VALUE></SETTING>
<SETTING><NAME>MWDebugger_EPPC_amcPowerTapMemWtDelay</NAME><VALUE>350</VALUE></SETTING>
<SETTING><NAME>MWDebugger_EPPC_amcCodeTapShowInstCycles</NAME><VALUE>None</VALUE></SETTING>
<SETTING><NAME>MWDebugger_EPPC_amcCodeTapClockFreq</NAME><VALUE>MHz_7_34</VALUE></SETTING>
<SETTING><NAME>MWDebugger_EPPC_amcPowerTapClockFreq</NAME><VALUE>MHz_5</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_msiSpeed</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_msiDevice</NAME><VALUE>Wiggler</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_fpuBuffAddr</NAME><VALUE>-1048576</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_ipAddrStr</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_pDebug_StdinFilename</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_pDebug_StdoutFilename</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_pDebug_StderrFilename</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_pDebug_Stdin</NAME><VALUE>stdFile1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_pDebug_Stdout</NAME><VALUE>stdFile1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_pDebug_Stderr</NAME><VALUE>stdFile1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_TS_Name</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_TS_Entry</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_TS_TaskPriority</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_TS_TaskOptions</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_TS_TaskStackSize</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_TS_Arguments</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_TS_KillThreads</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_TS_UnloadModule</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_EPPC_targetos</NAME><VALUE>0</VALUE></SETTING>
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        <SETTING><NAME>MWDebugger_EPPC_IMMRValue</NAME><VALUE>2</VALUE></SETTING>
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```
        <SETTING><NAME>MWDebugger_EPPC_pdebugShellName</NAME><VALUE></VALUE></SETTING>
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        <!-- Settings for "Debugger Remote" panel -->
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        <SETTING><NAME>MWDebugger_Remote_IDexecutable</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_Remote_IDconstant</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_Remote_IDinitialized</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_Remote_IDuninitialized</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_Remote_IVexecutable</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_Remote_IVconstant</NAME><VALUE>0</VALUE></SETTING>
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        <SETTING><NAME>MWDebugger_Remote_SDconstant</NAME><VALUE>1</VALUE></SETTING>
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        <SETTING><NAME>MWDebugger_Remote_SVexecutable</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDebugger_Remote_SVconstant</NAME><VALUE>0</VALUE></SETTING>
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        <!-- Settings for "EPPC Debugger" panel -->
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        <SETTING><NAME>IDexecutable</NAME><VALUE>1</VALUE></SETTING>
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        <SETTING><NAME>IDuninitialized</NAME><VALUE>0</VALUE></SETTING>
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        <SETTING><NAME>ShowMPC107regs</NAME><VALUE>0</VALUE></SETTING>

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555\src\phyCORE-MPC555_BDM_relocate_init.cfg</VALUE></SETTING>
        <SETTING><NAME>ConfigurationFile</NAME><VALUE></VALUE></SETTING>
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                <SETTING><NAME>PathFormat</NAME><VALUE>Windows</VALUE></SETTING>
                <SETTING><NAME>PathRoot</NAME><VALUE>Absolute</VALUE></SETTING>
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              <SETTING><NAME>PathFormat</NAME><VALUE>Windows</VALUE></SETTING>
              <SETTING><NAME>PathRoot</NAME><VALUE>CodeWarrior</VALUE></SETTING>
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          <SETTING>
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        </SETTING>

        <!-- Settings for "Target Settings" panel -->
        <SETTING><NAME>Linker</NAME><VALUE>Embedded PPC Linker</VALUE></SETTING>
        <SETTING><NAME>PreLinker</NAME><VALUE></VALUE></SETTING>
        <SETTING><NAME>PostLinker</NAME><VALUE></VALUE></SETTING>
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```
<SETTING><NAME>Targetname</NAME><VALUE>555 Phytec Debug Version</VALUE></SETTING>
<SETTING><NAME>OutputDirectory</NAME>
  <SETTING><NAME>Path</NAME><VALUE>Bin</VALUE></SETTING>
  <SETTING><NAME>PathFormat</NAME><VALUE>Windows</VALUE></SETTING>
  <SETTING><NAME>PathRoot</NAME><VALUE>Project</VALUE></SETTING>
</SETTING>
<SETTING><NAME>SaveEntriesUsingRelativePaths</NAME><VALUE>false</VALUE></SETTING>

<!-- Settings for "File Mappings" panel -->
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    <SETTING><NAME>FileExtension</NAME><VALUE></VALUE></SETTING>
    <SETTING><NAME>Compiler</NAME><VALUE>MW Lib Import PPC EABI</VALUE></SETTING>
    <SETTING><NAME>Precompile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>Launchable</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>ResourceFile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>IgnoredByMake</NAME><VALUE>false</VALUE></SETTING>
  </SETTING>
  <SETTING>
    <SETTING><NAME>FileType</NAME><VALUE>MPLF</VALUE></SETTING>
    <SETTING><NAME>FileExtension</NAME><VALUE></VALUE></SETTING>
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    <SETTING><NAME>Precompile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>Launchable</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>ResourceFile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>IgnoredByMake</NAME><VALUE>false</VALUE></SETTING>
  </SETTING>
  <SETTING>
    <SETTING><NAME>FileType</NAME><VALUE>TEXT</VALUE></SETTING>
    <SETTING><NAME>FileExtension</NAME><VALUE>.asm</VALUE></SETTING>
    <SETTING><NAME>Compiler</NAME><VALUE>MW Assembler PPC EABI</VALUE></SETTING>
    <SETTING><NAME>Precompile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>Launchable</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>ResourceFile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>IgnoredByMake</NAME><VALUE>false</VALUE></SETTING>
  </SETTING>
  <SETTING>
    <SETTING><NAME>FileType</NAME><VALUE>TEXT</VALUE></SETTING>
    <SETTING><NAME>FileExtension</NAME><VALUE>.c</VALUE></SETTING>
    <SETTING><NAME>Compiler</NAME><VALUE>MW C/C++ PPC EABI</VALUE></SETTING>
    <SETTING><NAME>Precompile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>Launchable</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>ResourceFile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>IgnoredByMake</NAME><VALUE>false</VALUE></SETTING>
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    <SETTING><NAME>Precompile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>Launchable</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>ResourceFile</NAME><VALUE>false</VALUE></SETTING>
    <SETTING><NAME>IgnoredByMake</NAME><VALUE>false</VALUE></SETTING>
  </SETTING>
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    <SETTING><NAME>Launchable</NAME><VALUE>false</VALUE></SETTING>
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```

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    <SETTING><NAME>IgnoredByMake</NAME><VALUE>true</VALUE></SETTING>
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    <SETTING><NAME>Launchable</NAME><VALUE>false</VALUE></SETTING>
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```

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    <SETTING>
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  </SETTING>

  <!-- Settings for "Build Extras" panel -->
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  <SETTING><NAME>DumpBrowserInfo</NAME><VALUE>true</VALUE></SETTING>
  <SETTING><NAME>CacheSubprojects</NAME><VALUE>true</VALUE></SETTING>
  <SETTING><NAME>UseThirdPartyDebugger</NAME><VALUE>false</VALUE></SETTING>
  <SETTING><NAME>DebuggerCommandLine</NAME><VALUE></VALUE></SETTING>

  <!-- Settings for "Remote Debug" panel -->
  <SETTING><NAME>Enabled</NAME><VALUE>true</VALUE></SETTING>
  <SETTING><NAME>ConnectionName</NAME><VALUE>MPC555DK Wiggler</VALUE></SETTING>
  <SETTING><NAME>DownloadPath</NAME><VALUE></VALUE></SETTING>
  <SETTING><NAME>LaunchRemoteApp</NAME><VALUE>false</VALUE></SETTING>
  <SETTING><NAME>RemoteAppPath</NAME><VALUE></VALUE></SETTING>

  <!-- Settings for "Debugger Target" panel -->
  <SETTING><NAME>LogSystemMessages</NAME><VALUE>flase</VALUE></SETTING>
  <SETTING><NAME>AutoTargetDLLs</NAME><VALUE>false</VALUE></SETTING>
  <SETTING><NAME>StopAtWatchpoints</NAME><VALUE>true</VALUE></SETTING>
  <SETTING><NAME>PauseWhileRunning</NAME><VALUE>false</VALUE></SETTING>
  <SETTING><NAME>PauseInterval</NAME><VALUE>5</VALUE></SETTING>
  <SETTING><NAME>PauseUIFlags</NAME><VALUE>0</VALUE></SETTING>
  <SETTING><NAME>AltExePath</NAME>
    <SETTING><NAME>Path</NAME><VALUE></VALUE></SETTING>
    <SETTING><NAME>PathFormat</NAME><VALUE>Generic</VALUE></SETTING>
    <SETTING><NAME>PathRoot</NAME><VALUE>Absolute</VALUE></SETTING>
  </SETTING>
  <SETTING><NAME>StopAtTempBPOnLaunch</NAME><VALUE>false</VALUE></SETTING>
  <SETTING><NAME>CacheSymbolics</NAME><VALUE>true</VALUE></SETTING>
  <SETTING><NAME>TempBPFunctionName</NAME><VALUE>__start</VALUE></SETTING>
  <SETTING><NAME>TempBPType</NAME><VALUE>false</VALUE></SETTING>

  <!-- Settings for "EPPC Exceptions" panel -->
  <SETTING><NAME>MWDebugger_EPPC_Exceptions</NAME>
    <SETTING><VALUE>1</VALUE></SETTING>
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    <SETTING><VALUE>1</VALUE></SETTING>
    <SETTING><VALUE>1</VALUE></SETTING>
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    <SETTING><VALUE>1</VALUE></SETTING>
  </SETTING>

  <!-- Settings for "Debugger Remote" panel -->
  <SETTING><NAME>MWDebugger_Remote_useconfig</NAME><VALUE>0</VALUE></SETTING>
  <SETTING><NAME>MWDebugger_Remote_IDexecutable</NAME><VALUE>1</VALUE></SETTING>
```

```
		<SETTING><NAME>MWDebugger_Remote_IDconstant</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_IDinitialized</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_IDuninitialized</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_IVexecutable</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_IVconstant</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_IVinitialized</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_IVuninitialized</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_SDexecutable</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_SDconstant</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_SDinitialized</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_SDuninitialized</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_SVexecutable</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_SVconstant</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_SVinitialized</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_SVuninitialized</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWDebugger_Remote_configpath</NAME><VALUE></VALUE></SETTING>

		<!-- Settings for "C/C++ Compiler" panel -->
		<SETTING><NAME>MWFrontEnd_C_cplusplus</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_checkprotos</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_arm</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_trigraphs</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_onlystdkeywords</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_enumsalwaysint</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_mpwpointerstyle</NAME><VALUE>0</VALUE></SETTING>

<SETTING><NAME>MWFrontEnd_C_prefixname</NAME><VALUE>Controlador_defines.h</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_ansistrict</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_mpwcnewline</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_wchar_type</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_enableexceptions</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_dontreusestrings</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_poolstrings</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_dontinline</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_useRTTI</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_multibyteaware</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_unsignedchars</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_autoinline</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_booltruefalse</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_direct_to_som</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_som_env_check</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_alwaysinline</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_inlinelevel</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_ecplusplus</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_objective_c</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWFrontEnd_C_defer_codegen</NAME><VALUE>0</VALUE></SETTING>

		<!-- Settings for "PPC EABI Assembler" panel -->
		<SETTING><NAME>MWAssembler_generate_listing_file</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_bra_l_16</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_prefix</NAME><VALUE></VALUE></SETTING>
		<SETTING><NAME>MWAssembler_colon</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_period</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_space</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_case_sensitive</NAME><VALUE>1</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_processor</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_model</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_big_endian</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_allow_64_bit</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_perform_C_preprocessing</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_expand_trigraph_sequences</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_embedded_pic</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_gnu_mode</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_debug</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_preprocess</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_source</NAME><VALUE></VALUE></SETTING>
		<SETTING><NAME>MWAssembler_dest</NAME><VALUE></VALUE></SETTING>
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		<SETTING><NAME>MWAssembler_include_path</NAME><VALUE></VALUE></SETTING>
		<SETTING><NAME>MWAssembler_define</NAME><VALUE></VALUE></SETTING>
		<SETTING><NAME>MWAssembler_progress</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_warnings</NAME><VALUE>0</VALUE></SETTING>
		<SETTING><NAME>MWAssembler_code</NAME><VALUE>0</VALUE></SETTING>

		<!-- Settings for "PPC EABI CodeGen" panel -->
		<SETTING><NAME>MWCodeGen_EPPC_structalignment</NAME><VALUE>PPC</VALUE></SETTING>
```

```
        <SETTING><NAME>MWCodeGen_EPPC_readonlystrings</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_pooldata</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_peephole</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_scheduling</NAME><VALUE>None</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_commonsect</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_floatingpoint</NAME><VALUE>Hardware</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_use_lmw_stmw</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_processor</NAME><VALUE>PPC_555</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_function_align</NAME><VALUE>Align_4</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_fpcontract</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_altivec</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_vrsave</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWCodeGen_EPPC_profiler</NAME><VALUE>0</VALUE></SETTING>

        <!-- Settings for "PPC EABI Disassembler" panel -->
        <SETTING><NAME>MWDisassembler_EPPC_verbose</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_showDWARF</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_relocateDWARF</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_showcode</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_extended</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_nohex</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_showdata</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_showexceptions</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_showheaders</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWDisassembler_EPPC_showsymtab</NAME><VALUE>1</VALUE></SETTING>

        <!-- Settings for "EPPC Global Optimizer" panel -->
        <SETTING><NAME>GlobalOptimizer_EPPC_optimizationlevel</NAME><VALUE>Level0</VALUE></SETTING>
        <SETTING><NAME>GlobalOptimizer_EPPC_optfor</NAME><VALUE>Speed</VALUE></SETTING>

        <!-- Settings for "PPC EABI Linker" panel -->
        <SETTING><NAME>MWLinker_EPPC_linksym</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_symfullpath</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_linkmap</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_nolinkwarnings</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_genSrecFile</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_linkunused</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_use_lcf</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_use_codeaddr</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_use_dataaddr</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_use_sdataaddr</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_use_sdata2addr</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_use_stackaddr</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_use_heapaddr</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_genROMimage</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_codeaddr</NAME><VALUE>-1040384</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_dataaddr</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_smalldataaddr</NAME><VALUE>0</VALUE></SETTING>
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        <SETTING><NAME>MWLinker_EPPC_stackaddr</NAME><VALUE>-786448</VALUE></SETTING>
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        <SETTING><NAME>MWLinker_EPPC_romimage_addr</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_srecLength</NAME><VALUE>26</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_srecEOL</NAME><VALUE>DOS</VALUE></SETTING>

<SETTING><NAME>MWLinker_EPPC_mainname</NAME><VALUE>Controlador_initialize</VALUE></SETTING>
        <SETTING><NAME>MWLinker_EPPC_heapaddr</NAME><VALUE>0</VALUE></SETTING>

        <!-- Settings for "PPC EABI Project" panel -->
        <SETTING><NAME>MWProject_EPPC_projtype</NAME><VALUE>Application</VALUE></SETTING>
<!-- There is an issue with the length of the path being supplied. This works around a long absolute path. -->
<!--
<SETTING><NAME>MWProject_EPPC_outfile</NAME><VALUE>C:\MATLAB6p5\work\Controlador.elf</VALUE></SETTI
NG> -->
        <SETTING><NAME>MWProject_EPPC_outfile</NAME><VALUE>..\..\Controlador.elf</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_heapsize</NAME><VALUE>32</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_stacksize</NAME><VALUE>32</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_bigendian</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_datathreshold</NAME><VALUE>8</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_sdata2threshold</NAME><VALUE>8</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_codeModel</NAME><VALUE>1</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_disable_extensions</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_deadstrip_partiallink</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_final_partiallink</NAME><VALUE>0</VALUE></SETTING>
        <SETTING><NAME>MWProject_EPPC_resolved_partiallink</NAME><VALUE>0</VALUE></SETTING>
```

```
            <!-- Settings for "Target Connection" panel -->
            <SETTING><NAME>MWDebug_Connection_port</NAME><VALUE>Com1</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_rate</NAME><VALUE>Baud19200</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_databits</NAME><VALUE>Bits8</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_stopbits</NAME><VALUE>Bits1</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_parity</NAME><VALUE>None</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_flowcontrol</NAME><VALUE>None</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_logdata</NAME><VALUE>0</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_port2</NAME><VALUE>Com1</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_rate2</NAME><VALUE>Baud38400</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_databits2</NAME><VALUE>Bits8</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_stopbits2</NAME><VALUE>Bits1</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_parity2</NAME><VALUE>None</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_flowcontrol2</NAME><VALUE>None</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_logdata2</NAME><VALUE>0</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_connectiontype</NAME><VALUE>Serial</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_useglobal_serial1</NAME><VALUE>0</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_useglobal_serial2</NAME><VALUE>0</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_useglobal_tcpip</NAME><VALUE>0</VALUE></SETTING>
            <SETTING><NAME>MWDebug_Connection_hostname</NAME><VALUE>hostname</VALUE></SETTING>

            <!-- Settings for "C/C++ Warnings" panel -->
            <SETTING><NAME>MWWarning_C_warn_illpragma</NAME><VALUE>1</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_warn_emptydecl</NAME><VALUE>1</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_warn_possunwant</NAME><VALUE>1</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_warn_unusedvar</NAME><VALUE>1</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_warn_unusedarg</NAME><VALUE>1</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_warn_extracomma</NAME><VALUE>1</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_pedantic</NAME><VALUE>1</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_warningerrors</NAME><VALUE>0</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_warn_hidevirtual</NAME><VALUE>1</VALUE></SETTING>
            <SETTING><NAME>MWWarning_C_warn_implicitconv</NAME><VALUE>1</VALUE></SETTING>
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              <PATHFORMAT>Windows</PATHFORMAT>
              <FILEKIND>Text</FILEKIND>
              <FILEFLAGS>Debug</FILEFLAGS>
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          <PATHFORMAT>Windows</PATHFORMAT>
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  <PATHFORMAT>Windows</PATHFORMAT>
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```

```
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          <PATHFORMAT>Windows</PATHFORMAT>
        </FILEREF>
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      <GROUP><NAME>RTWlibraries</NAME>
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          <PATHTYPE>Name</PATHTYPE>
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          <PATHFORMAT>Windows</PATHFORMAT>
        </FILEREF>
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        <PATHFORMAT>Windows</PATHFORMAT>
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     </GROUP>
   </GROUPLIST>
</PROJECT>
```

6.4.2 Controlador2.xml.

A continuación se mostrará un ejemplo de un proyecto *XML* generado mediante la intefaz de *Motorola*, pero incluyendo las modificaciones realizadas sobre los archivos *gen_xml.tlc* y *gen_xml_lib.tcl* para que *CodeWarrior* lo interprete con un proyecto *MCP* para *ATMEL*. Sea:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<?codewarrior exportversion="1.0.1" ideversion="4.2" ?>

<!DOCTYPE PROJECT [
<!ELEMENT PROJECT (TARGETLIST, TARGETORDER, GROUPLIST, DESIGNLIST?)>
<!ELEMENT TARGETLIST (TARGET+)>
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<!ELEMENT OVERLAYGROUP (NAME, BASEADDRESS, OVERLAY*)>
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<!ELEMENT FRAMEWORKLIST (FRAMEWORK+)>
<!ELEMENT FRAMEWORK (FILEREF, LIBRARYFILE?, VERSION?)>
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        <!-- Settings for "Access Paths" panel -->
        <SETTING><NAME>AlwaysSearchUserPaths</NAME><VALUE>false</VALUE></SETTING>
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  <SETTING><NAME>MWRuntimeSettings_EnvVars</NAME><VALUE></VALUE></SETTING>

  <!-- Settings for "Target Settings" panel -->
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  <SETTING><NAME>PostLinker</NAME><VALUE></VALUE></SETTING>
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      <SETTING><NAME>EditLanguage</NAME><VALUE>C/C++</VALUE></SETTING>
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      <SETTING><NAME>Launchable</NAME><VALUE>false</VALUE></SETTING>
      <SETTING><NAME>ResourceFile</NAME><VALUE>false</VALUE></SETTING>
```

```
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    <SETTING><NAME>EditLanguage</NAME><VALUE>C/C++</VALUE></SETTING>
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    <SETTING><NAME>EditLanguage</NAME><VALUE></VALUE></SETTING>
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      <SETTING><NAME>ResourceFile</NAME><VALUE>false</VALUE></SETTING>
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  <!-- Settings for "Build Extras" panel -->
  <SETTING><NAME>CacheModDates</NAME><VALUE>true</VALUE></SETTING>
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  <SETTING><NAME>CacheSubprojects</NAME><VALUE>true</VALUE></SETTING>
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  <!-- Settings for "Debugger Target" panel -->
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  <!-- Settings for "Remote Debug" panel -->
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<!-- Settings for "Auto-target" panel -->
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