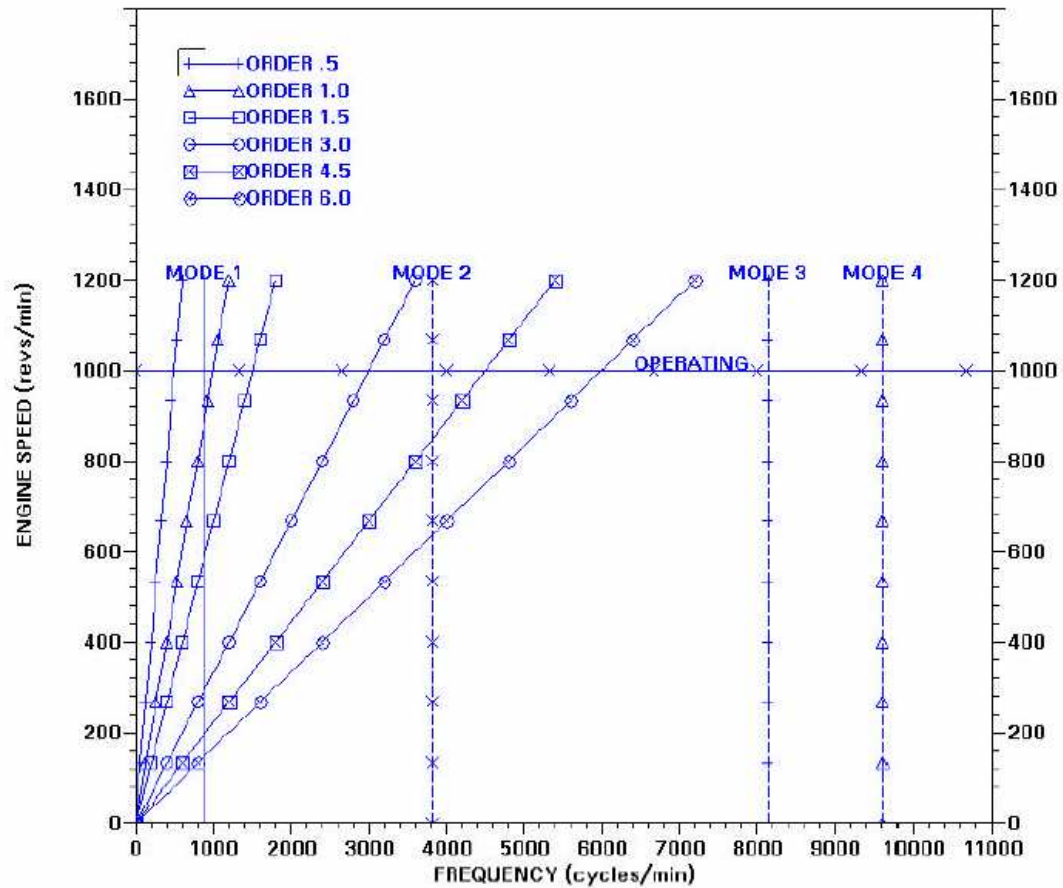
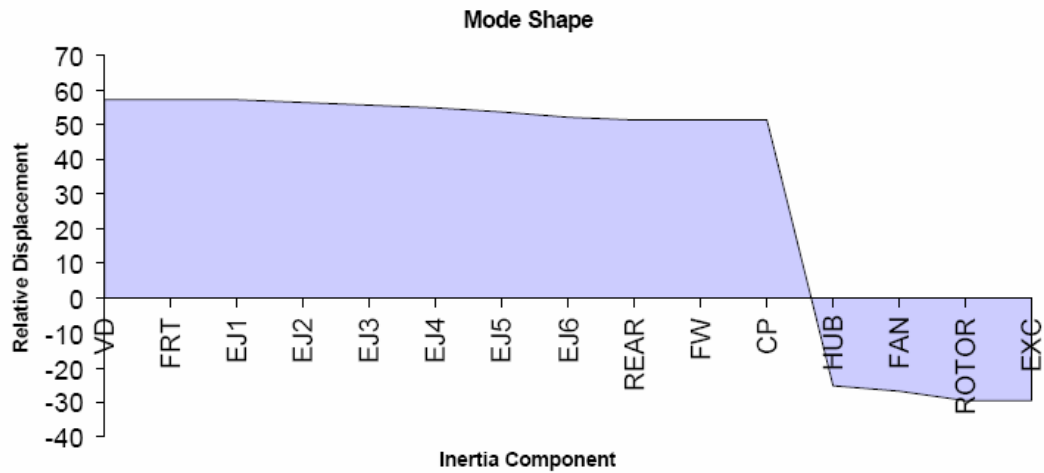


Anexo 11: Resultados simulación Análisis Vibraciones Torsionales

Resonant Speed Diagram

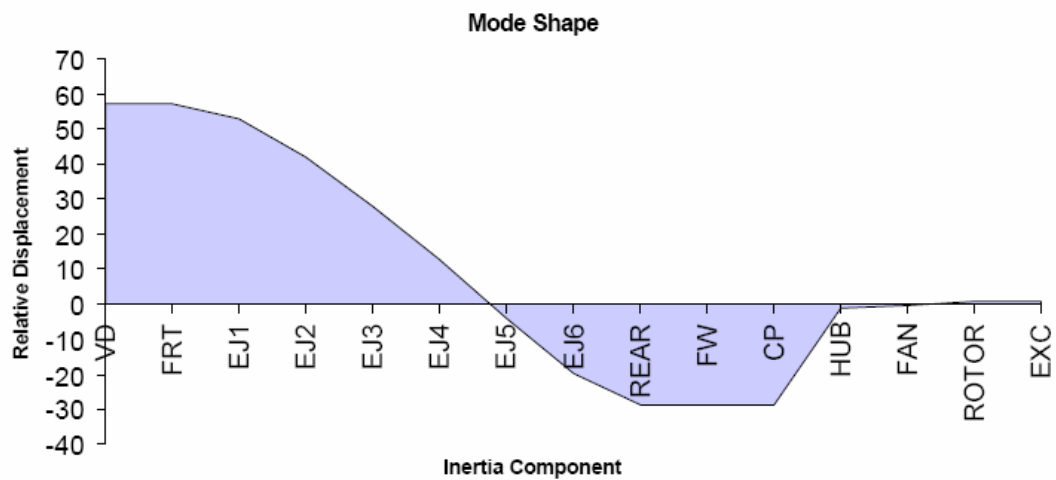


First Natural Frequency Occurs at 877 CPM



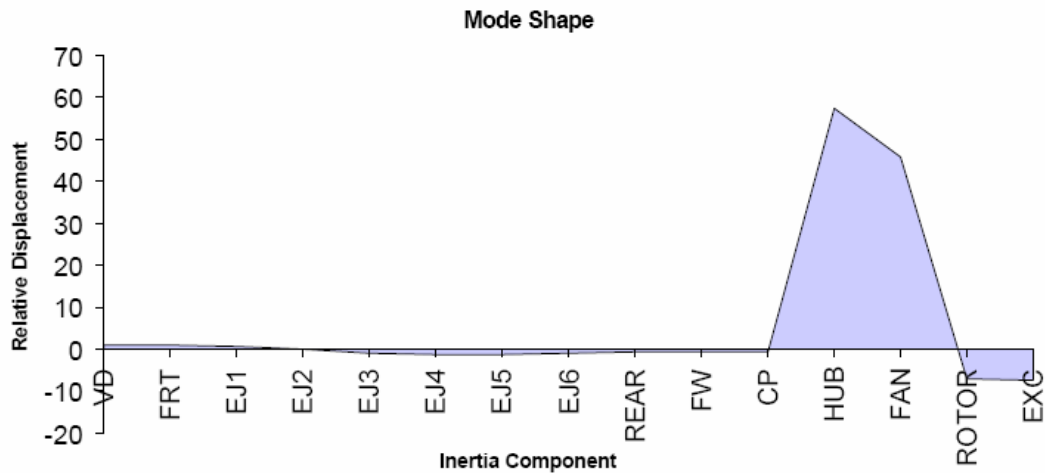
MASS ID	MASS NAME	INERTIA (N*m*sec^2)	DISPLACE (degrees)	SPRING ID	STIFFNESS (MN*m/rad)	CUM TORQUE (N*m)	DIAMETER (mm)	STRESS (MPa)
VD		2.686E+01	5.730E+01		0.000E+00	2.265E+05	0.000E+00	0.000E+00
FRT		5.645E+00	5.730E+01	EK1	6.780E+01	2.741E+05	2.160E+02	2.417E+00
EJ1		1.700E+01	5.706E+01	EK2	4.011E+01	4.168E+05	2.160E+02	3.677E+00
EJ2		1.632E+01	5.647E+01	EK3	4.011E+01	5.525E+05	2.160E+02	4.873E+00
EJ3		1.632E+01	5.568E+01	EK4	4.011E+01	6.862E+05	2.160E+02	6.052E+00
EJ4		1.632E+01	5.470E+01	EK5	4.011E+01	8.175E+05	2.160E+02	7.211E+00
EJ5		1.632E+01	5.353E+01	EK6	4.011E+01	9.461E+05	2.160E+02	8.345E+00
EJ6		1.700E+01	5.218E+01	EK7	6.780E+01	1.077E+06	2.160E+02	9.496E+00
REAR		5.826E+00	5.127E+01		0.000E+00	1.121E+06	0.000E+00	0.000E+00
FW		7.490E+01	5.127E+01		0.000E+00	1.686E+06	0.000E+00	0.000E+00
CP		5.900E+01	5.127E+01	CPK	1.600E+00	2.131E+06	0.000E+00	0.000E+00
HUB		2.030E+01	-2.504E+01	GK1	6.580E+01	2.056E+06	2.000E+02	2.285E+01
FAN		4.600E+01	-2.683E+01	GK2	4.309E+01	1.874E+06	2.100E+02	1.799E+01
ROTOR		4.287E+02	-2.932E+01	GK3	9.390E+01	2.482E+04	2.600E+02	1.255E-01
EXC		5.750E+00	-2.933E+01		0.000E+00	-2.070E-01	0.000E+00	0.000E+00

Second Natural Frequency Occurs at 3815 CPM



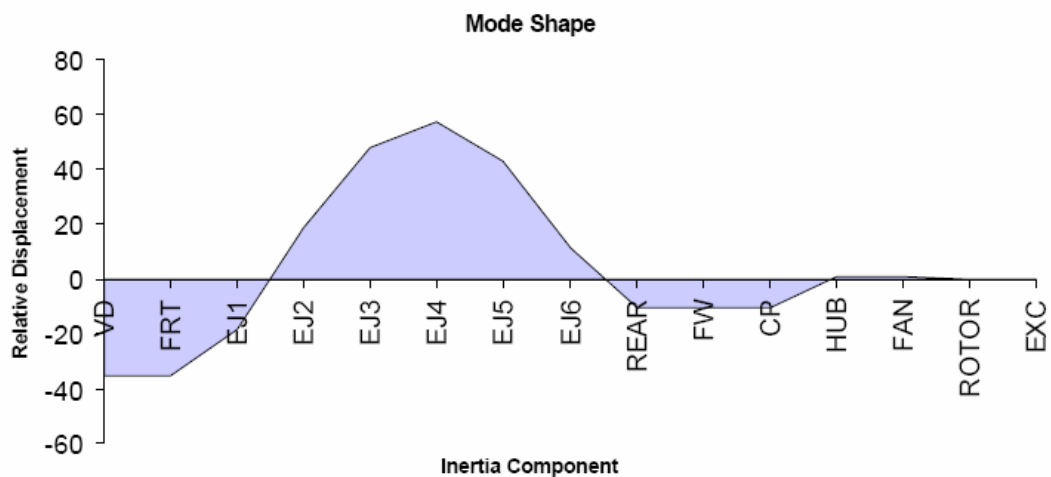
MASS ID	MASS NAME	INERTIA (N*m*sec^2)	DISPLACE (degrees)	SPRING ID	STIFFNESS (MN*m/rad)	CUM TORQUE (N*m)	DIAMETER (mm)	STRESS (MPa)
VD		2.686E+01	5.730E+01		0.000E+00	4.286E+06	0.000E+00	0.000E+00
FRT		5.645E+00	5.730E+01	EK1	6.780E+01	5.187E+06	2.160E+02	4.575E+01
EJ1		1.700E+01	5.291E+01	EK2	4.011E+01	7.692E+06	2.160E+02	6.785E+01
EJ2		1.632E+01	4.192E+01	EK3	4.011E+01	9.598E+06	2.160E+02	8.465E+01
EJ3		1.632E+01	2.821E+01	EK4	4.011E+01	1.088E+07	2.160E+02	9.597E+01
EJ4		1.632E+01	1.267E+01	EK5	4.011E+01	1.146E+07	2.160E+02	1.010E+02
EJ5		1.632E+01	-3.691E+00	EK6	4.011E+01	1.129E+07	2.160E+02	9.957E+01
EJ6		1.700E+01	-1.982E+01	EK7	6.780E+01	1.035E+07	2.160E+02	9.129E+01
REAR		5.826E+00	-2.856E+01		0.000E+00	9.887E+06	0.000E+00	0.000E+00
FW		7.490E+01	-2.856E+01		0.000E+00	3.928E+06	0.000E+00	0.000E+00
CP		5.900E+01	-2.856E+01	CPK	1.600E+00	-7.649E+05	0.000E+00	0.000E+00
HUB		2.030E+01	-1.171E+00	GK1	6.580E+01	-8.311E+05	2.000E+02	9.235E+00
FAN		4.600E+01	-4.471E-01	GK2	4.309E+01	-8.884E+05	2.100E+02	8.527E+00
ROTOR		4.287E+02	7.341E-01	GK3	9.390E+01	-1.187E+04	2.600E+02	6.005E-02
EXC		5.750E+00	7.414E-01		0.000E+00	-4.482E-01	0.000E+00	0.000E+00

Third Natural Frequency Occurs at 8144 CPM



MASS ID	MASS NAME	INERTIA (N*m*sec^2)	DISPLACE (degrees)	SPRING ID	STIFFNESS (MN*m/rad)	CUM TORQUE (N*m)	DIAMETER (mm)	STRESS (MPa)
VD		2.686E+01	9.434E-01		0.000E+00	3.217E+05	0.000E+00	0.000E+00
FRT		5.645E+00	9.434E-01	EK1	6.780E+01	3.893E+05	2.160E+02	3.434E+00
EJ1		1.700E+01	6.144E-01	EK2	4.011E+01	5.219E+05	2.160E+02	4.603E+00
EJ2		1.632E+01	-1.311E-01	EK3	4.011E+01	4.947E+05	2.160E+02	4.364E+00
EJ3		1.632E+01	-8.378E-01	EK4	4.011E+01	3.211E+05	2.160E+02	2.833E+00
EJ4		1.632E+01	-1.297E+00	EK5	4.011E+01	5.252E+04	2.160E+02	4.633E-01
EJ5		1.632E+01	-1.372E+00	EK6	4.011E+01	-2.316E+05	2.160E+02	2.043E+00
EJ6		1.700E+01	-1.041E+00	EK7	6.780E+01	-4.562E+05	2.160E+02	4.024E+00
REAR		5.826E+00	-6.551E-01		0.000E+00	-5.047E+05	0.000E+00	0.000E+00
FW		7.490E+01	-6.551E-01		0.000E+00	-1.128E+06	0.000E+00	0.000E+00
CP		5.900E+01	-6.551E-01	CPK	1.600E+00	-1.618E+06	0.000E+00	0.000E+00
HUB		2.030E+01	5.730E+01	GK1	6.580E+01	1.315E+07	2.000E+02	1.461E+02
FAN		4.600E+01	4.585E+01	GK2	4.309E+01	3.992E+07	2.100E+02	3.832E+02
ROTOR		4.287E+02	-7.234E+00	GK3	9.390E+01	5.526E+05	2.600E+02	2.795E+00
EXC		5.750E+00	-7.571E+00		0.000E+00	1.260E+00	0.000E+00	0.000E+00

Fourth Natural Frequency Occurs at 9611 CPM



MASS ID	MASS NAME	INERTIA (N*m*sec ²)	DISPLACE (degrees)	SPRING ID	STIFFNESS (MN*m/rad)	CUM TORQUE (N*m)	DIAMETER (mm)	STRESS (MPa)
VD		2.686E+01	-3.539E+01		0.000E+00	-1.681E+07	0.000E+00	0.000E+00
FRT		5.645E+00	-3.539E+01	EK1	6.780E+01	-2.034E+07	2.160E+02	1.794E+02
EJ1		1.700E+01	-1.820E+01	EK2	4.011E+01	-2.581E+07	2.160E+02	2.276E+02
EJ2		1.632E+01	1.867E+01	EK3	4.011E+01	-2.042E+07	2.160E+02	1.801E+02
EJ3		1.632E+01	4.784E+01	EK4	4.011E+01	-6.620E+06	2.160E+02	5.839E+01
EJ4		1.632E+01	5.730E+01	EK5	4.011E+01	9.913E+06	2.160E+02	8.743E+01
EJ5		1.632E+01	4.314E+01	EK6	4.011E+01	2.236E+07	2.160E+02	1.972E+02
EJ6		1.700E+01	1.120E+01	EK7	6.780E+01	2.572E+07	2.160E+02	2.269E+02
REAR		5.826E+00	-1.054E+01		0.000E+00	2.464E+07	0.000E+00	0.000E+00
FW		7.490E+01	-1.054E+01		0.000E+00	1.068E+07	0.000E+00	0.000E+00
CP		5.900E+01	-1.054E+01	CPK	1.600E+00	-3.208E+05	0.000E+00	0.000E+00
HUB		2.030E+01	9.466E-01	GK1	6.580E+01	1.891E+04	2.000E+02	2.101E-01
FAN		4.600E+01	9.302E-01	GK2	4.309E+01	7.754E+05	2.100E+02	7.443E+00
ROTOR		4.287E+02	-1.009E-01	GK3	9.390E+01	1.093E+04	2.600E+02	5.528E-02
EXC		5.750E+00	-1.075E-01		0.000E+00	-1.430E+00	0.000E+00	0.000E+00

Single Order Results		Order	Predicted	Permissible Limit
FRT	Absolute Amplitude (deg)	0.5	0.016	1.00
	Absolute Amplitude (deg)	1.0	0.033	1.00
	Absolute Amplitude (deg)	1.5	0.095	0.25
	Absolute Amplitude (deg)	3.0	0.009	0.15
	Absolute Amplitude (deg)	4.5	0.107	0.15
	Absolute Amplitude (deg)	6.0	0.043	0.15
EK5	Vibratory Stress (MPa)	0.5	1.62	21.0
	Vibratory Stress (MPa)	1.0	12.99	21.0
	Vibratory Stress (MPa)	1.5	12.97	21.0
	Vibratory Stress (MPa)	3.0	2.07	21.0
	Vibratory Stress (MPa)	4.5	10.94	21.0
	Vibratory Stress (MPa)	6.0	3.21	21.0
GK1	Vibratory Stress (MPa)	0.5	0.06	34.5
	Vibratory Stress (MPa)	1.0	0.75	34.5
	Vibratory Stress (MPa)	1.5	1.52	34.5
	Vibratory Stress (MPa)	3.0	0.59	34.5
	Vibratory Stress (MPa)	4.5	1.00	34.5
	Vibratory Stress (MPa)	6.0	0.17	34.5
	Vibratory Stress (MPa)	7.5	0.30	34.5
	Vibratory Stress (MPa)	8.0	0.45	34.5

Combined Order Results		Predicted	Permissible Limit
VD	Power Absorbed (kW/m ²)	4.0	5.7
CPK	Maximum Torque (Nm)	41522	134000
	Vibratory Torque (Nm)	5471	25200
	Nominal Torque (Nm)	35332	63000
	Power Loss (kW)	0.15	1.06

Single Order Misfire Results		Order	Predicted	Permissible Limit
FRT	Absolute Amplitude (deg)	0.5	0.081	1.00
	Absolute Amplitude (deg)	1.0	0.510	1.00
EK5	Vibratory Stress (MPa)	0.5	4.21	21.0
	Vibratory Stress (MPa)	1.0	16.50	21.0
GK1	Vibratory Stress (MPa)	0.5	3.79	34.5
	Vibratory Stress (MPa)	1.0	11.72	34.5

Combined Order Misfire Results		Predicted	Permissible Limit
VD	Power Absorbed (kW/m ²)	4.0	5.7
CPK	Maximum Torque (Nm)	61179	134000
	Vibratory Torque (Nm)	24186	25200
	Nominal Torque (Nm)	35332	63000
	Power Loss (kW)	2.02	1.06
Engine misfire may cause significant torsional vibration in the coupling, as indicated by high vibratory torque and power loss levels. This vibration would cause the coupling rubber elements to warm, changing their elastic properties. See warm coupling results beginning on page 25 for a more accurate representation of engine misfire behavior.			

