

Chapter 6

Conclusions

A middle ear model of GP was carried out in this job using the Multibody Systems techniques. This model consisted in two bodies, modeled as rigid solids, eight constraints modeled as spring-damping combination elements, nine generalized coordinates and a vector of external forces.

A procedure to estimate the mechanical properties of the ossicles was developed. In order to use this procedure it is necessary the geometrical data of the ossicles, density of the two kind of bones and cortical bone thickness. This procedure was checked with well-known human data and the results were good enough. Furthermore, a sensitivity analysis of the cortical bone thickness was carried out and it was possible to see that the procedure was not very sensible to this parameter. Thus, a reasonable value of this parameter was taken and the mechanical properties were calculated.

A procedure to estimate the attachment points of the ligaments to the ossicles were carried out. With this procedure is possible to get a rough idea of the location of these points. It is useful to get a more realistic graphical representation of the model, as well.

Since there are not available data about the mechanical properties of the ligaments and muscles, they were estimated taking the human data and scaling them. Anyway, a sensitivity analysis of these parameters was carried out. This analysis was focused on the responsible parameters in the first eigenmode motion. The results showed the range of influence of the model parameters in the static response of the system as well as in the three first eigenfrequencies.

An adjustment of the model parameters was carried out in order to fit the model results

with the available measurements. It was possible to see that the first eigenfrequency and the first eigenmode fitted pretty good, as well as the transfer function, with the experimental results. Besides, the nine first eigenfrequencies and eigenmodes were calculated in order to get a more general idea of the behavior of the model.

As a future work it is necessary to get reliable data about the guinea pig anatomy in order to be able to have a better estimation of the mechanical properties of the ligaments and muscles as well as the location of their attachment points to the bones. It is also necessary to continue with the sensitivity analysis of the model parameters in order to get a better static response of the transfer function as well as a better frequency response of the rocking motions.