1. Problem description

The human ear can be divided into three basic parts: the outer ear, the middle ear, and the inner ear. The outer ear consists of the auricle, the outer ear canal and the outer part of the eardrum. The middle ear consists of the eardrum, ossicles (malleus, incus and stapes), ligaments and tendons that stabilize the ossicles, the Eustachian tube and the outer part of the oval window. The inner ear consists of: the cochlea, semicircular canals and the auditory nerve.

Modelling the human ear and sound conduction is essential to investigate aspects of hearing that are difficult to discover from experimental research. The model can be used to determine the basic mechanisms related to the hearing process and to investigate the states of hearing disorders.

High intensity noise (e.g. military explosion) over 170 dB SPL may result in otolaryngological injuries and hearing damage. In addition to research into into hearing loss is essential to better understand, prevent and counter the effects of the many factors that significantly contribute to hearing loss. However, quantifying hearing disorders is difficult for a number of reasons. Hearing impairment, for example, in both animal and human models raises ethical questions and is limited in practice.

2. Purpose of the project and research description

The aim of the project is to model the middle ear with an implant and to investigate double excitation. One of the forces is the sound that traditionally sets the eardrum in motion, while the other is the implant that moves stapes into motion. The auditory ossicles will be modeled using computer microtomography. The simulation results on the models will be compared with the results obtained experimentally. The project will investigate the influence of double excitation and its effects on sound conduction in the human ear.

3. Expected effects

One of the most important results is whether in the human ear, stimulation with an implant and sound reaching the eardrum interferes with hearing. The result of the research may be appropriate parameters assigned to the implant, which will be able to correct the disturbance resulting from the double excitation.