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Implantable Microphone: A Middle Ear Ossicular Vibration Sensor

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With upcoming fully implantable cochlear implants and hearing aid systems, there is a big demand for implantable microphones that accomplish the characteristics of a typical hearing aid microphone. An implantable microphone based on a vibration sensor is presented. The idea of the approach is to incorporate the normal middle ear function into the implantable microphone and to make use of the middle ear and outer ear transfer characteristics. The tympanic membrane serves as a natural microphone membrane that transfers the sound signal into structural vibrations of the ossicular chain. These vibrations are picked up by a piezoelectric sensor at the long process of the incus. Numerical simulations are compared with experiments performed on human cadaveric temporal bone preparations comprising an experimental prototype of the piezoelectric sensor. Experiments, simulations and the process of mathematical model building affecting the sensor design are discussed.