International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol.2, No.4, August 2012

NUMERICAL STUDIES OF TRAPEZOIDAL PROTOTYPE AUDITORY MEMBRANE (PAM)

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ABSTRACT

In this research, we developed numerically a Prototype Auditory Membrane (PAM) for a fully implantable and self contained artificial cochlea. Cochleae are one of the important organs for hearing in the human and animals. Material of the prototype and implant of PAM are made of Polyvinylidene fluoride (PVDF)- Kureha, Japan which is fabricated using MEMS and thin film technologies. Another important thing in the characteristic of the PAM is not only convert the acoustic wave into electric signal but also the frequency selectivity. The thickness, Young's modulus and density of the PAM are 40 µm, 4 GPa, and 1.79 × 10³ kg/m³, respectively. The shape and dimension of the PAM is trapezoidal with the width is linearly changed from 2.0 to 4.0 mm with the length are 30 mm. Numerically, we develop the model of PAM is based on commercial CFD software, Fluent 6.3.26 and Gambit 2.4.6. The geometry model of the PAM consists of one-sided blocks of quadrilateral elements for 2D model and tetrahedral elements for 3 D model respectively. In this study we set the flow as laminar and carried out using unsteady time dependent calculation. The results show that the frequency selectivity of the membrane is detected on the membrane surface.

KEYWORDS

Cochlea, PVDF, PAM, Frequency Selectivity

1. INTRODUCTION

As a medical treatment for sensorineural hearing loss in children and adults, cochlear implant is recently used [1][2]. The current cochlear implant consist of an implant stimulating electrodes and an extracorporeal device, which bypass the damaged hair cells by generating electric current