

Modeling and Simulation of Hearing with Cochlear Implants: A Proposed Method for Better Auralization

Soft Computing Applications pp 753-767

- A. M. Kuczapski (1) Email author (artur.kuczapski@aut.upt.ro)
- G.-D. Andreescu (1)

1. Politehnica University of Timisoara, Timisoara, Romania

Conference paper

First Online:

03 November 2015

DOI (Digital Object Identifier): 10.1007/978-3-319-18416-6_59

- [307 Downloads](#)

Part of the [Advances in Intelligent Systems and Computing](#) book series (AISC, volume 357)

Cite this paper as:

Kuczapski A.M., Andreescu GD. (2016) Modeling and Simulation of Hearing with Cochlear Implants: A Proposed Method for Better Auralization. In: Balas V., Jain L., Kovačević B. (eds) Soft Computing Applications. Advances in Intelligent Systems and Computing, vol 357. Springer, Cham

Abstract

Cochlear implants are the most successful and widespread bionic prosthetics to restore hearing of deaf people by electrically stimulation of intra-cochlear nerve tissues. Several stimulation strategies were developed to convert sound in electric stimuli aiming to give better hearing quality. To help the development of new stimulation strategies, hearing simulations (auralization methods) were developed to synthesize perceived sound from electric stimuli. Existing auralization approaches are based on the observations that the stimulation place and rate of the cochlear nerve tissues generate perceived sounds of different frequencies and amplitudes. Although, auralization results can give some insight on the hearing quality, they completely ignore the adaptation capability of the auditory cortex and therefore it can represent only the perceived hearing of newly implanted patients. This paper presents fundamentals of natural hearing and artificial hearing through cochlear implant, analyzes two main auralization methods, and finally proposes a novel auralization method. In the proposed method, the neural nerve firing pattern evoked by electric stimulation is fed to an artificial neural network trained to output the frequency domain representation of the original sound given by the electric stimuli. Then, the