UNIVERSITÄT ZU LÜBECK

FACH HOCHSCHULE LÜBECK
University of Applied Sciences

Program: Biomedical Engineering

Master's Thesis

Title: Design and Evaluation of a Closed-loop Controller for an Inductive Transcutaneous Energy Supply of a Myoelectric Prosthetic Implant

Summary:

The big improvement of the implantable medical devices raises the requirements to improve the energy management. Previously used battery and percutaneous cables lead to lifetime limitation and big risk of infection. The wireless power transmission helps to overcome these problems. The coil misalignment due to the skin movements and a dislocation of an implant identify an aim to create closed-loop control system to constantly keeping induced voltage on the implant just above the required level to avoid malfunctioning (not enough power) and overheating (too much power).
The goal of the project was to analyse and implement a control-loop to regulate wireless power transmission between base station and myoelectric implant. First, components of the closed-loop were presented and their connection and role were explained. Then, implementation of the software for base station as a controller was discussed. Then, the preliminary analyses of the wireless power transmission process were performed and controller components were examined. Finally, based on the previous results the PID-control was tuned based on Ziegler-Nichols' tuning method.
The results show that current coil geometry is not capable to keep voltage due to literal and vertical misalignments, which proves requirement of the closed-loop. Unfortunately, due to slow reaction of the power supply on the command to change voltage, the usage of PID controller is not feasible. Possible solutions to the problem are described in the outlook section.

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