



## Thesis Project Form

**Title (tentative):** Modelling human behavior during closed-loop control of a bionic limb

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### Description

#### Motivation and application domain

The feedback systems for bionic prostheses are designed ad-hoc based on the preference of the researchers or availability of equipment, and then tested to assess the impact of the interface on closed-loop prosthesis control. So far, the outcomes of such tests were not consistent as the feedback sometimes improved prosthesis performance whereas in some cases, the feedback showed no benefit.

#### General objectives and main activities

The main objective is to develop a model of closed-loop prosthesis control to allow a more principled approach to understanding the feedback and predicting its impact. This will facilitate the development of more effective interfaces that can improve the utility of bionic limbs.

The activities will include: investigating the state of the art in the methods and technologies to provide artificial sensory feedback to the user of a prosthesis; and exploring the contemporary theories of human motor control, such as the acquisition and use of internal models, optimal control, and state estimation. The insights from human motor control and computational neuroscience will then be used to formulate models to further our understanding of the role and benefits of artificial sensory feedback in prostheses.

The activities will also include an experimental assessment of the developed modelling approach.

#### Training Objectives (technical/analytical tools, experimental methodologies)

State of the art in technology of robotic prostheses

â€¢ Prosthesis control using electromyography (EMG)

â€¢ Technology to convey haptic feedback (electro- and vibrotactile stimulation)

â€¢ Theories of human motor control

â€¢ Mathematical modelling of human behavior (human-in-the-loop)

â€¢ Design, planning, and execution of experiments on human subjects

**Place(s) where the thesis work will be carried out:** Faculty of Medicine, Aalborg University, Denmark

### Additional information

**Maximum number of students:** 1

**Financial support/scholarship:** Erasmus