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Development of a Mathematical Rowing Model

Summer student project for May-August 2018, supervised by **Dr. Kei Masani** and mentored by Pirashanth Theventhiran

Target Student Population(s)

Undergraduate student in mathematics, engineering or computer science in years 3-4.

Brief Project Description

Functional Electrical Stimulation (FES) involves invoking artificial muscle contractions using an electric current which can be used to rehabilitate and restore functional ability in individuals with spinal cord injury. FES-rowing is a clinical rehabilitation exercise that has shown cardiovascular and musculoskeletal benefits in SCI individuals. Our project involves developing an understanding for the coordination between upper and lower limbs during FES-rowing. This project will involve an analysis of existing rowing models in the literature and combining them to suit the specific rowing machine in our laboratory. This will allow for deeper understanding of how the human body moves during the rowing exercise, which will help optimize the cardiovascular and musculoskeletal benefits.

Expected Learning Outcomes

Through this project, we expect you to learn the following-

1. Framing a research question
2. Effectively reading scientific literature to identify existing 2D and 3D rowing models
3. Data analyses on center of mass during rowing from the literature
4. Combine the models to create the best model that suits our specific rowing machine (based on the information we extract from our rowing machine)
5. Writing scientific reports to report your developments and your findings
6. Presenting your work to audiences from a diverse set of backgrounds.

Expected Research Outcomes

The summer student will be able to contribute to a current research project in the Rehabilitation Engineering Laboratory. They will be developing a model that could be used to develop a deeper understanding of the data collected from the modified rowing machine in our laboratory. Every effort will be made to recognize the student's contributions to the research project and the journal and/or conference publications that come out of it. The student's work could help expand our research on optimizing the timing between upper and lower limb coordination during FES rowing.

Required technical Skills

- Mandatory skills: Deep knowledge in mathematical modelling
- Optional skills: Previous modelling experience or knowledge of biomechanics

Updated: 26th November 2017

Funding

Funding for this project may be obtained through competitive scholarship: NSERC USRA and IBBME Director's Awards. It is the student's responsibility to apply in a timely manner, with the approval and assistance of their supervisor.

Application Details

To apply for this project, you must first complete the IBBME USRP application (Note: only need to do this once). Once you've don't that, please email your updated CV and a statement of intent to **Dr. Kei Masani (k.masani@utoronto.ca)** and to **Pirashanth Theventhiran (pirashanth.theventhiran@mail.utoronto.ca).** Explain briefly why you are interested by the project and its outcomes, and why you would be a good fit for this project. Please also provide your latest transcript (can be unofficial) to help us assess your chances to obtain funding. The subject of your email should be "*Summer Student Application: Development of a Mathematical Rowing Model*".