IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Modeling of Tool-Tissue Interaction for Surgical Simulators with Haptic Feedback**	
Project Number	**IMURA0332**	
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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(*Feel free to nominate more than one. For more information, see www.iitbmonash.org)*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

Surgical simulators are important for training the surgeons but most of the surgical simulators use simplified tool-tissue interaction because of the real time feedback required. To improve the feedback of the surgical simulators realistic tool-tissue interaction finite models need to developed, which will be the kernel for the feedback from the haptic device. It is known that the tissue response will be a function of force (applied by the surgeon), tool position and the path taken by the surgeon. This project will be focused on developing tool-tissue interaction models for predicting the feedback which could directly be fed to the haptic device if the simulations can be done real time. In case real time computationsare slow, the realistic simulations will be carried out offline and fit metamodels which could then be used for feedback from the haptic device.

Project aims

Following specific objectives have been identified:

- Development of material model of soft tissuebehavior
- Modeling the contact mechanics of tool-tissue interaction
- Developing metamodels for tool-tissue response as a function of path and time histories
- Integrating the tool-tissue interaction behavior to the haptic feedback of the surgical simulator

Expected outcomes

Highlight the expected outcomes of the project

The outcomes of this project will be:

- Development of a realistic surgical simulator based on haptic feedback
- Different types of tissues can be modeled for training laproscopic surgeons of different organs

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

This project will help in building realistic simulators which capture the response of the tissue as experienced by the surgeon in a laproscopic surgery.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

Masters in Mechanical Engineering or Applied Mechanics.