

An Indian-Australian research partnership

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| Project Title: | Tactile sensor array for biomedical applications | |
| Project Number | IMURA0701 | |
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Research Clusters:

Research Themes:

| Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST <u>one</u>. For more information, see www.iitbmonash.org)</i> | | Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see www.iitbmonash.org)</i> | |
|--|---|--|--|
| 1 | Material Science/Engineering (including Nano, Metallurgy) | 1 | Advanced computational engineering, simulation and manufacture |
| 2 | Energy, Green Chem, Chemistry, Catalysis, Reaction Eng | 2 | Infrastructure Engineering |
| 3 | Math, CFD, Modelling, Manufacturing | 3 | Clean Energy |
| 4 | CSE, IT, Optimisation, Data, Sensors , Systems, Signal Processing, Control | 4 | Water |
| 5 | Earth Sciences and Civil Engineering (Geo, Water, Climate) | 5 | Nanotechnology |
| 6 | Bio, Stem Cells, Bio Chem, Pharma, Food | 6 | Biotechnology and Stem Cell Research |
| 7 | Semi-Conductors , Optics, Photonics, Networks, Telecomm, Power Eng | | |
| 8 | HSS, Design, Management | | |

The research problem

In the last few decades, robotics is rapidly growing, with a special interest in the medical field. The attributes of robotic tools in medicine have demonstrated their usefulness in various

applications, such as in microsurgery or minimal invasive surgery, bladder and intraocular applications, detection and characterization of tumor or cancer cells, long term monitoring of prosthetic devices etc. For all of these applications, 'tactile sensors' which are responsible of contact information for biomedical devices are essential. These sensors have natural features which characterize human behavior, such as ability to feel, grasp and manipulate objects, assess attributes such as shape, size, texture, temperature, hardness, discontinuities such as holes or edges, and movement, including vibration. Thus biomedical devices having tactile sensors will be able to provide sensory inputs similar to those possessed by humans to explore and interact with objects. However, conventional tactile sensors that are available today are typically rigid and in solid-state form, restricting various natural body movements when used and may also be subjected to plastic deformation and failure when pressure is exerted, resulting in compromises in conformability, durability and overall robustness. These issues led them being inherently incompatible for making intimate and large area contacts with the body. Further, they contain bulky cables for signal conduction and have high sensitivity to motion, which make them uncomfortable to wear for a prolonged time. Technologies of the future therefore must address these issues by designing electronics that readily integrate with the soft, curvilinear, and dynamic surfaces of the human body. In this context, the proposal aims to develop tactile sensor arrays using flexible/stretchable electronics concepts which will have huge potential to not only avoid the above mentioned limitations, but also create completely novel and highly sensitive devices.

Project aims

- Development of highly flexible and sensitive elastic composite film with interlocked microstructured arrays
- Process development and material identification
- Developing photolithography process to obtain different kinds of microstructures

Expected outcomes

- Fabrication of tactile sensors with ultra-flexible platforms and useful for socially relevant diseases and treatments such as in prosthetics, minimal invasive surgery and identification of tumor/cancerous cells.
- Techniques and methods for reliable, reproducible and cost-effective production of tactile sensors
- Manpower training
- Patents, Publications, and PhD thesis

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

The research area in the field of Tactile sensors is highly interdisciplinary and will encompass concepts of Material Science, 'Nanotechnology', and Biotechnology.

Capabilities and Degrees Required

We are looking for 1 Ph.D. student in this project; Candidates with following academic background is desired.

1. M.Tech in Materials Science/Materials Engg/Chemical /Mechanical Engg, Biomedical, Electrical and Instrumentation Engg
2. M.Sc in Chemistry/Physics

Potential Collaborators

Select up to **(4)** keywords from the Academy's approved keyword list (**available at www.iitbmonash.org**) relating to this project to make it easier for the students to apply.

Tactile sensors, Novel functional materials; Nanotechnology/nanoscience; Sensor and Sensor Networks; Materials Chemistry/Science