Project Title:	Particles sorting using fluid-structure interaction: Combined numerical and experimental investigation	
Project Number	IMURA0472	
Monash Main Supervisor (Name, Email Id, Phone) **Monash Co-supervisor(s)** (Name, Email Id, Phone)	Tuncay Alan Tuncay.Alan@monash.edu	*Full name, Email*
Monash Department:	Mechanical and Aerospace Engineering	
IITB Main Supervisor (Name, Email Id, Phone) **IITB Co-supervisor(s)** (Name, Email Id, Phone)	**Rajneesh Bhardwaj**, Assistant Prof, Mechanical Engg	*Full name, Email*
IITB Department:	Mechanical Engineering	

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

This project will focus on vortices resulting from vibrating microscale structures in the presence of fluid flow. The analysis of the flows in these microfluidic systems generally involves complex three-dimensional moving solid-fluid and fluid-fluid interfaces, and flow-induced deformation of often compliant structures. The flow in many of the above applications is highly unsteady and the modeling of the structure also involves geometric and material nonlinearities. While modeling of the flow and the structure are challenging in their own right, the coupled fluid-structure interaction raises the challenge to an even higher level. The student working on this project will combine an in-house built immersed-boundary method based FSI solver with experimental validations to investigate the flow patterns under various conditions and develop a novel system to sort biological cells. Numerical simulations will be corroborated with measurements in order to validate the model. Since the measurements of flow fields in above applications are not trivial, the proposed computation tool will provide detailed insights in the respective biophysics.

Project aims

The aims of this project are the following:
- Employ an FSI solver for particles sorting
- Understand the flow physics by combining experiment with numerics.

Expected outcomes

We expect the following outcomes from this project
- Quality Ph.D. graduate with ability and skills to understand particle interaction with unsteady vortices.

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

The target of the project is to model particle dynamics in incompressible flows and understand flow physics via combing experimental and numerical data. Thus, the project will address the goals of above theme (Advanced computational engineering, simulation and manufacture). The sorting techniques developed here will be helpful in Nanotechnology theme as well.

Capabilities and Degrees Required

The student for this project will require the following skills
- Sound background in fluid mechanics and numerical methods.
- Experience with performing experiments and simulations. If not, a willingness to learn is essential.
- Good written and communication skills.

Potentia Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.