



**UPM**  
UNIVERSITI PUTRA MALAYSIA  
BERILMU BERBAKTI

# INSPEM WEEKLY SEMINAR

36/2018

## Date & Time

26 October 2018 (Friday) @ 3.15 pm

## Venue

Al-Farabi Seminar Room,  
Second Floor, INSPEM

## Presenter

**Prof. Dr. Mustafa Turkyilmazoglu**

(Visiting Scientist, Hacettepe University,  
Ankara, Turkey)



## Topic

**LIQUID PLUG FLOW IN MOVING MICRO-CHANNELS**

## Abstract

The wide applications of plug flows in microscale in science and engineering help them attract a great deal recent interest. The dedication of the current work is towards exploration of the flow behaviour in a liquid plug interacting with the walls of a moving micro-channel. An analytical study is undertaken to study the impacts of a transversely applied external uniform magnetic field affecting the motion of liquid in the plug in terms of hydrodynamic mixing properties. The well-known symmetric vortex structure occurring in a long plug with moderate aspect ratio is observed to be preserved, while the recirculation phenomenon is highly affected by the action of the magnetic field. The decelerating feature of Lorentz force on the liquid motion is illuminated by reducing the strength of the recirculating vortex moving towards the upper and lower walls. The effects of magnetic field on the flow resistance of the liquid plug as well as on the plug circulation rate and on the axial flux are also clarified. The derived analytical formulae associated with the streamlines and vector fields are much useful for verification of computational plug flow simulations and potential experimental validations in the ongoing research. The liquid plug considered here is shown to be fully consistent with the continuous liquid flow in a channel whose exact solution is further extracted.