# INSTITUTE OF MATHEMATICAL SCIENCES
# UNIVERSITY OF MALAYA

## SIRI SEMINAR KUMPULAN PENYELIDIKAN

**Title:** Numerical Prediction of Ureter Stone Size Using An Integrated CFD-ML Approach.
**Speaker:** Assoc. Prof. Dr. Noor Fadiya Mohd Noor.
**Date:** 20/12/2024 (Friday).
**Time:** 10am – 11am.
**Venue:** Microsoft Teams ( https://shorturl.at/NWqFH ).


### ABSTRACT

Ureteral flow parameters provide significant details about its physical attributes. The ureter is a single transport medium for urine transmission from the kidney to the ureter, and its health is very important for a healthy human body. Understanding the fluid flow behavior can contribute towards ureter health monitoring, including estimation of any kind of blockage in the flow. Using ANSYS Fluent, Computational Fluid Dynamics (CFD) analysis and the grid independence study are carried out through an iterative simulation process to achieve solution independence. The CFD modeling provides tools and techniques to observe varying fluid parameters such as pressure, velocity and effect of flow on smooth walls. Fluid Structure Interaction (FSI), an effective technique to analyze the effects of such flows on the ureter walls is also employed. Although the exact modeling of the ureter wall is not possible due to its complex physical parameters, some of its available physiological properties can be used to visualize the model of the ureter numerically. The present study is intended to predict the ureter stone size by using the FSI analysis. The simulations are carried out by gradually increasing the stone size from 1.7 mm to 3.4 mm, and the input flow parameters are compared with the output flow parameters within the same solution setup and boundary conditions via an artificial neural network in MATLAB. The output results obtained from the FSI simulations are then utilized to generate a prediction model for the ureter stone size. It is observed that the increasing stone size has a significant effect on the ureter wall, causing high stress regions in the point of interaction. The findings also revealed that the predicted size of the ureter stone is the closest to the actual size and with the least mean squared error at 80 optimal neurons.


*All are Welcome*