National Institute of Technology Rourkela

Registration Seminar

Seminar Title	: Estimation and Identification in Biomolecular Networks: Integrating Stochastic Filtering with Learning-Based Methods
Speaker	: Suryasnata Dash (Rollno : 523ee1001)
Supervisor	: Abhishek Dey
Venue	: EE401
Date and Time	: 16 Apr 2025 (4:30 pm)

Abstract : State and parameter estimation in biomolecular networks is essential for application in modelling and control in biology. Most biological processes are modeled as Chemical Reaction Networks (CRN) which have nonlinear dynamics with effect of noise on state trajectories which makes this problem challenging. To tackle this, firstly we propose a Continuous Discrete-Extended Kalman Filter (CD-EKF) based on Chemical Langevin Equation (CLE) dynamics for estimating state and parameters of full and reduced order CRN models. We observe the accuracy of filter and compare with established Adaptive Kalman Filters (AKF). Secondly, we propose to investigate how process noise based on system information can be used for Particle Filters and Markov Chain Monte Carlo (MCMC) methods. We also plan to investigate the performance for Particle Filter fed by optimized parameters through Expectation-Maximization algorithm. Thirdly, we plan to carry out research on ML based approaches for identification of biomolecular systems. The objective can be extended to improve estimation accuracy and generalizability of the system for the Physics Informed Neural Networks (PINN) in presence of noise. This research should be relevant in addressing current challenges faced in identification of biomolecular systems offering novel approaches through both filtering and learning-based methods.