



XIAMEN UNIVERSITY MALAYSIA

廈門大學 馬來西亞分校

## Research Talk

# NUMERICAL OPTIMIZATION OF BIOPROCESSES

November 6, 2023 (Monday), 3:30–4:30 pm Room A5#G11



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Research interests: Numerical analysis, (fractional) optimal control theory, (fractional) partial differential equations, mathematical biology, and nonlinear programming.

## SPEAKER INTRODUCTION

Dr. Kareem Elgindy is an Associate Professor at Xiamen University Malaysia graduated on 2013 from Monash University, Melbourne.

## ABSTRACT

Bioprocesses play an important role in medical therapies, immunization procedures, the pharmaceutical industry, food processing and production, biofuel production, agriculture, and environmental management, among other areas. Continuous bioprocesses are often studied by chemostat experiments, which use a specialized device designed for the continuous cultivation of microorganisms or cells that grow continually in a specific phase of growth while competing for a single limiting nutrient under carefully controlled conditions. Theoretical results predicted and numerical experiments confirmed that under certain conditions of cell growth rate, substrate concentration, and dilution rate, a periodically operated chemostat exhibits an “overyielding” state in which the performance becomes higher than that at steady-state operation. In this talk, we show that an optimal periodic control policy for maximizing chemostat performance can be accurately and efficiently derived numerically using a novel class of integral pseudospectral methods and adaptive h-IPS methods composed through a predictor–corrector algorithm and combined with the interior-point algorithm.