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|  |  |  הטכניון - מכון טכנולוגי לישראל TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY  |
| הפקולטה להנדסה כימיתע"ש וולפסון |  |  |
| The Wolfson Department of Chemical Engineering |  |  |

**Wolfson Department of Chemical Engineering Seminar**

**Monday, April 15th, 2024 at 13:30**

**Zoom:** https://technion.zoom.us/j/96298325147

**Development of a comprehensive numerical simulation tool of algal growth for pneumatic photobioreactors in OpenFOAM**

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**MSc Seminar**

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Biological capture of CO2 by photosynthetic microalgae in photobioreactors (PBRs) has received widespread attention over the past few years. The design and performance of PBRs must be further improved to investigate how to increase biomass yield and conversion while reducing energy consumption. Numerical modeling is a cost-effective way in the forefront to reduce design costs and improve reactor efficiency. However, numerous physical, chemical, and biological phenomena occur inside a microalgal PBR. Besides, complex interrelationships also exist between these multiphysics processes on multiple temporal and spatial scales. Therefore, we developed a multiphysics numerical simulation tool for a pneumatic PBR using OpenFOAM. The tool fully integrates three sub-models, which adapt the multiphase Eulerian model for hydrodynamics, the finite volume discrete ordinate model (FVDOM) for radiative transport, and the photosynthetic unit (PSU) growth model for algal growth kinetics. The tool addresses the problem of different time scales for different sub-models by deriving the average growth rate in one period to update biomass concentration for modeling hydrodynamics, radiation, and algal growth in the next period. In particular, the radiation transport component is equipped to accommodate the light scattering of flowing air bubbles and he algal growth kinetics component adapts Wu’s photosynthetic unit model. The modeling tool was first validated by comparing the light distribution and biomass concentration predictions with corresponding experimental data and subsequently, a industrialized large-scale PBR configuration was simulated to obtain internal flow fields, predict the light distribution and algae biomass concentration.

Refreshments will be served at 13:15.