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| הפקולטה להנדסה כימית  ע"ש וולפסון |  |  |
| The Wolfson Department of Chemical Engineering |  |  |

**Wolfson Department of Chemical Engineering Seminar**

**Monday, March 4th, 2024 at 14:00**

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

**Evaluation of Droplets Breakup Models of Emulsification Process in a Liquid-Liquid Taylor-Couette Flow**

**Yijian He**

**MSc Seminar**

Advisor: Prof. Bo Kong (GTIIT), Prof. Simon Brandon (Technion)

Department of Chemical Engineering, Technion-Israel Institute for Technology

Liquid-liquid (L-L) emulsion systems are widely used in food, pharmaceutical, chemical, and other processes. The droplet size distribution (DSD) is a crucial parameter in these emulsion systems, with breakup often playing a dominant role in the emulsification process. To study the performance of breakup models in the simulation of the L-L emulsion flow, the computational fluid dynamics (CFD) and population balance model (PBM) were adopted for the turbulent L-L emulsion flow inside the Taylor-Couette (TC) flow. Quadrature Based Moments Method (QBMM) was employed to solve the population balance equation. The continuous phase flow field was modeled using the Reynold Stress model (RSM) and validated against available PIV experiments. Various breakup kernels and daughter size distribution models for L-L emulsion systems were tested inside the TC flow. Generally, we found the breakup kernel determines the mean droplet diameter, whereas the daughter size distribution function influences the DSD shape more. The coefficients in the CT (Coulaloglou, C. A.; Tavlarides, L. L. Chemical Engineering Science 1977, 32 (11), 1289) and Chen (Chen, Z.; Prüss, J.; Warnecke, H. J. Chemical Engineering Science 1998, 53, 1059) breakup kernel were adjusted using the method proposed by Ravichandar et al. (Ravichandar, K.; Olsen, M. G.; Dennis Vigil, R. Chemical Engineering Science 2023, 266, 118311), and it was found to be unsuitable in the studied liquid systems. The MB (Martínez-Bazán, C.; Montañés, J. L.; Lasheras, J. C. J. Fluid Mech. 1999, 401, 157) and Lehr (Lehr, F.; Millies, M.; Mewes, D. AIChE J. 2002, 48 (11), 2426) breakup kernels better predicted the mean droplet diameter, but they were not applicable in high dispersed phase viscosity systems in L-L TC flow. The M-shaped Lehr daughter size distribution function showed diverse characteristics under different conditions and exhibited optimal performance within specific parameters.