

COMPUTATION OF FLOW AND INTERFACIAL TRANSPORT IN LIQUID-LIQUID SYSTEMS

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This lecture provides a short review of the modeling papers presented at the 1997 International Symposium "Liquid-Liquid Two-Phase Flow and Transport Phenomena" held in Antalya, Turkey. It then deals with modeling of drag and heat transfer between an array of particles in close proximity. It extends the work of the first author and his students on the formulation of a so-called spherical annulus model. Utilizing the commercial code FLUENT, a study is presented of the three dimensional flow through an array of identical spherical particles arranged in a face centered cubic cell structure. Calculations are presented of flow fields, pressure drop and particle surface transport.

Results show that after two particles in depth that a periodic behavior of the flow occurs for a void fraction of 0.4. For a void fraction of 0.8 the periodic nature of the flow occurs after only three particles. Thus, an array of seven particles in depth provides the characteristics of much greater arrays.

Using the models for the spherical annulus model and the 3Dfcc model, Nusselt Numbers were determined over a range of Reynolds numbers and for void fractions representative of flow over an isolated sphere to flow through a packed bed. It was shown that the Nusselt number for particles at internal locations that were higher than at the leading edge. Further it was shown that the peak heat transfer for these particles is not at the forward stagnation point, but occurs in the area of lowest flow area. It is also shown that the spheres at the front and back of an array have lower drag coefficients than do intermediate spheres for most void fractions. This leads to the conclusion of bunching up of an array at its rear and spreading at the front.