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Flow Measurements in Single and Multiphase Mixing Processes

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Abstract

Power Number – Flow Number Relationship with Axial Flow Impellers

Flow Number measurements obtained from LDA data for a wide variety of axial flow impellers (including both narrow and wide blade hydrofoils, as well as pitched blade turbines, 16 impellers in total) are correlated with Power number measurements obtained from the same impellers. The resulting correlation, of the form $Fl = C\ Po^{1/3}$, is presented and compared with the performance of several radial flow impellers. Data on the effect of reducing the Reynolds number into the transitional and laminar regimes on Flow Number and Power number will also be presented. LDA data (including turbulent mean and RMS velocities, as well as calculated Flow numbers) collected at two scales (T=0.3m and T=1.86m) for both a D=T/3 Pitched Blade Turbine and a D=T/3 RDT are also presented and compared.

Comments and examples of the most appropriate methods for the measurement and calculation of both Impeller Flow numbers and Impeller Power numbers will be included.

LDA Measurements in Immiscible Liquid-Liquid Systems

LDA measurements were made of both mean and turbulent fluctuating components of velocity in both the dispersed and continuous phases of an immiscible liquid dispersion agitated in a standard baffled T=0.3m stirred vessel with a pitched blade turbine. The measurements were obtained by using two fluids (glycerol solution and TTFE) with matching refractive indexes, and by adding seeding particles to each fluid separately. Results were obtained with dispersed phase fractions up to 35%, and these were also compared to data obtained in the corresponding single phase system.

Differences in both flow patters and turbulence parameters between phases were measured in some parts of the vessel, while no significant differences were observed in other parts. The differences in the mean velocities between the single and two phase results (the two phase system has smaller recirculation loops) are believed to arise from density differences. Differences between the flow patterns and turbulence levels between the two phases of the immiscible liquid system were observed in the impeller discharge and tip vortex region.