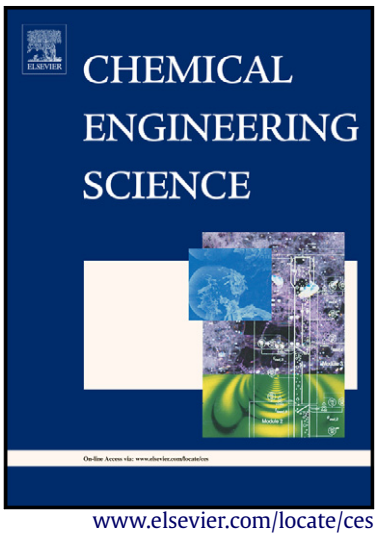

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Time-Series Analysis of Optical Probe Measurements in Gas-Liquid Stirred Tanks

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Time-series analysis, optical probe, gas-liquid stirred tank, multiphase reactor

Abstract

This work reports our findings on the time and frequency domain analysis of the optical probe measurements in a lab scale gas-liquid stirred tank reactor alternatively equipped with (i) a standard Rushton turbine and (ii) a half circular blades disk turbine. Optical measurements are collected from the tapered (conical) ends of optical fibers at five radial positions on the impeller discharge plane in the tank, r = 0.4R, 0.5R, 0.6R, 0.7R, 0.8R, at a range of operating conditions. The collected data are processed and analyzed in the time and the frequency domains via MATLAB algorithms developed in house. The time domain analysis provided useful dispersion parameters, such as the local gas phase holdup and the bubble count, and the frequency domain analysis revealed information regarding the chaotic nature of bubble occupancy as a function of position and operating conditions. For both systems, the distinct pattern of the bubbles generated by the blades became chaotic beyond certain distances from the impeller at all operating conditions. In the vicinity of the impeller, however, different patterns are observed for the two turbines. These results suggest the optical probe's potential usage as a tool for impeller design