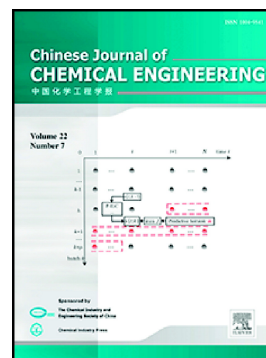


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Fluid Dynamics and Transport Phenomena

Coupling simulation of fluid structure interaction in the stirred vessel with a pitched blade turbine[☆]

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Abstract

The interaction between fluid and a down-pumping pitched blade turbine fixed with a flexible shaft in the stirred vessel, as a typical fluid structure interaction phenomenon, was simulated by coupling the Computational Fluid Dynamics and Computational Structural Dynamics. Based on the verification of the simulated impeller torque and dimensionless shaft bending moment with experimental result, the dimensionless shaft bending moment and various loads acting on impeller (including lateral force, axial force and bending moment) were discussed in detail. By separating and extracting the fluid and structural components from those loads, the results show that the shaft bending moment mainly results from the lateral force on impeller although the axial force on impeller is much larger. The impeller mass imbalance increases the shaft bending moment and the lateral force on impeller, but has little influence on the axial force and bending moment acting on impeller. The dominant frequencies of impeller forces are macro-frequency, speed frequency and blade passing frequency, and are associated with the impeller mass imbalance.

Keywords

Fluid structure interaction; Shaft bending moment; Impeller lateral force; Impeller axial force; Bending moment on impeller

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