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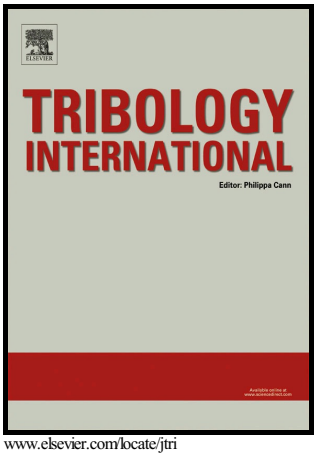

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A hybrid approach to the numerical solution of air flow field in aerostatic thrust bearings

Yujie Zhou[1], Xuedong Chen[1], Han Chen[1,2]

Abstract

In the design and analysis of ultra-precision aerostatic thrust bearings, computational fluid dynamics (CFD) methods, which numerically solve the laminar/turbulent Navier-Stokes (N-S) equations, have been adopted to resolve complex flow behaviors in the bearing. In this paper, a hybrid approach is proposed to numerically calculate the air flow field in aerostatic thrust bearings, which decomposes the solution domain into an inner region near the restrictor where the laminar/turbulent N-S equations are solved, and an outer region where the Reynolds equation is solved. Applications of the proposed hybrid approach in circular aerostatic thrust bearings with cylindrical and rectangular recesses demonstrate its accuracy and remarkable computational efficiency compared with solving N-S equations in the whole domain.

Keywords

Aerostatic thrust bearing; numerical simulation; hybrid approach; speedup

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