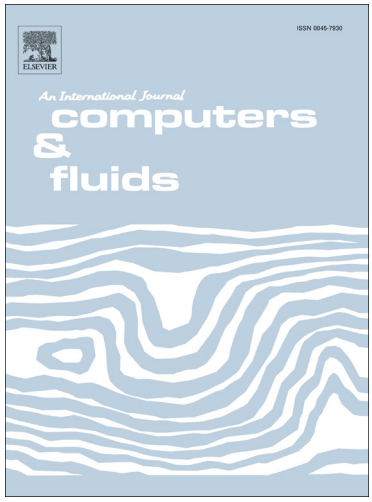

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Flow structure in a short chamber of a labyrinth seal with a backward-facing step

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Abstract

The paper studies the direction of the main vortex in a short chamber with a backward-facing step. The starting-point of the work was a computational issue observed during CFD-based modeling of labyrinth gas seals. The predicted main vortex in a sealing cavity with a backward-facing step could develop either counter-clockwise or clockwise depending on the iteration step size of a pseudo-transient coupled CFD solver. First, the paper presents a comprehensive theoretical analysis of the flow structure in a generic chamber with a backward-facing step to isolate the possible sources of numerical uncertainties, among them computational grid, turbulence model, boundary and initial conditions, and solution algorithm. For the studied chamber configuration, the non-unique steady-state solutions could be observed in all model formulations depending on the iteration step sizes. Based upon these results, the observed computational issue is an example of spurious numerical behavior. Solely segregated SIMPLE-type solvers and coupled pseudo-

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