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Stochastic Simulation of Flow Instabilities in a Rotating Cylinder[1] S. HADI SEYEDI, ALI AKHAVAN-SAFAEI, JOHN FOSS, MOHSEN ZAYERNOURI, Michigan State University — A rotating cylinder subject to an imperfect/ random rotational brake system is modeled and simulated to better understand the stochastic nonlinear nature of vorticity dynamics, arising from the uncertain initial/ boundary/ topological conditions. The rotating cylinder, fully filled with water, arrives at rest within a short time-period from a constant rotational speed. We employ spectral element method to perform highly-accurate, complex-geometry capturing, and cost-efficient direct numerical simulation of the fluid flow. Given available experimental (PIV) data, the corresponding forward and backward uncertainty quantifications are also performed. This study leads to the Bayesian inference of the stochastic brake system input parameters in addition to the investigation of forward uncertainty propagation from the available data and model into the flow fields, hence predictive simulations of flow instabilities.

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S. Hadi Seyedi
Michigan State University

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