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Physics informed neural networks for fluid-flow-induced flutter of a flexible cylinder

Jeongsu Lee

Department of Mechanical, Smart, and Industrial Engineering Civil Engineering, Gachon University, Seongnam 13120, Korea
leejeongsu@gachon.ac.kr

ABSTRACT

Physical informed neural networks (PINN) model to resolve the fluid-flow-induced flutter of a flexible cylinder is presented. The structural dynamics of a flexible cylinder is modeled based on the Euler-Bernoulli beam bending theory by additionally considering the fluid dynamic pressure. The fluid dynamic pressure is considered based on the classic slender body theory of Lighthill(1970). The presented PINN model is tested over several conditions including free oscillation of a simply supported beam, a cantilevered beam and the oscillation under axial flows. Strategies to resolving high-order coupled partial differential equations are suggested, which is expected to complement the existing knowledge to construct physical informed neural networks model for various differential equations.

REFERENCE

Lighthill, M.J. (1970). Aquatic animal propulsion of high hydromechanical efficiency. *J. Fluid Mech*, **44**(2), 265-301.