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Parametric Optimization for Power Generation of Flow Induced Vibration Energy Harvester
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Abstract
Flow-induced vibration occurs when the motion of fluids through a structure induces oscillations or vibrations in the structure. An effective flow-induced vibration energy harvester has substantial challenges due to the river's irregular velocity flows. It is not practicable to use one parameter for all velocities. This work presents the testing of a flow-induced vibrational energy harvester in laminar flow using two circular cylinders positioned in tandem within an open-channel flow. A CFD simulation using COMSOL Multiphysics was performed for the proposed parameter. A comprehensive simulation run at multiple Reynolds numbers with varying gap lengths between the bluff bodies is studied to determine the maximum power generated. Simulation results show that the optimal gap lengths for Re 60, 80, 100, 120, 140, and 160 are 8.5, 6.0, 3.0, 3.0, 3.5, and 4.5, respectively. These gap lengths result in power outputs of 0.0315 W, 2.616 W, 1.899 W, 0.6552 W, 0.5018 W, and 0.3782 W. By demonstrating the relationship between Reynolds number and gap length, this study provides important information for maximising the energy harvesting from flow-induced vibration (FIV).

Author Keywords
flow-induced vibration (FIV); gap length; piezoelectric; Reynolds number; vortex-induced vibration (VIV); wake-induced vibration (WIV)

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