

Extended Hamilton's Principle for Fluid-Structure Interaction

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In 1973, McIver published a work with broad implications for modeling complex fluid-structure interactions. The central feature of his work was the broadening of Hamilton's principle to include integral control volume concepts from fluid mechanics. His work focused on internal flows.

Our interest here is the vortex-induced oscillations of bluff bodies. McIver's work initiated our efforts. The problem of vortex shedding from bluff bodies has been examined for over a century, as reflected by the extensive literature on the subject. The focus of this work can be split into two broad categories: investigations into the flow characteristics around a body in a flow, and studies of the response of a bluff body to the forces from the flow.

The approach sought here, to derive a set of equations of motion for a structure subjected to vortex-shedding loads from first principles, represents a novel approach to a long-studied problem. The work at hand also embraces two disciplines: vortex-shedding from bluff bodies, and the dynamics of a compliant offshore structure.