

On the Effects of External Cross-Flow Excitation Forces on the Vortex-Induced-Vibrations of an Oscillating Cylinder

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Abstract : Vortex induced vibrations can significantly affect the effectiveness of structures in aerospace as well as offshore marine industries. The oscillatory nature of the forces resulting from the vortex shedding around bluff bodies can result in undesirable effects such as increased loading, stresses, deflections, vibrations and noise in the structures, and also reduced fatigue life of the structures. To date, most studies concentrate on either the free oscillations or the prescribed motion of the bluff bodies. However, the structures in operation are usually subject to the external oscillatory forces (e.g. due to the platform motions in offshore industries). In this work, we present the effects of the external cross-flow forces on the vortex-induced vibrations of an oscillating cylinder. The effects of the amplitude, as well as the frequency of the external force on the fluid-forces on the oscillating cylinder are carefully studied and presented. Moreover, we present the transition of the response to be dominated by the vortex-induced-vibrations to the range where it is mostly dictated by the external oscillatory forces. Furthermore, we will discuss how the external forces can affect the flow structures around a cylinder. All results are compared against free oscillations of the cylinder.

Keywords : circular cylinder, external force, vortex-shedding, VIV

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