

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

Authors : Abouzar Kaboudian, Ravi Chaithanya Mysa, Boo Cheong Khoo, Rajeev Kumar Jaiman

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). Periodic forces can be considered as a combinations of sinusoids. In this work, we present the effects of sinusoidal external cross-flow forces on the vortex-induced vibrations of an oscillating cylinder. The effects of the amplitude, as well as the frequency of these sinusoidal 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

Conference Title : ICFD 2015 : International Conference on Fluid Dynamics

Conference Location : Los Angeles, United States

Conference Dates : April 03-04, 2015