Simulation of Vortex-Induced Vibration for a Long and Flexible Riser Using Discrete Vortex Method

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Abstract

A discrete vortex method (DVM) that describes the flow field by a series of vortex particles traced in the Lagrangian frame was used as a basic CFD method. The strip theory based solving a series 2D plane CFD problems with DVM coupling with the structural dynamical equations was applied to simulate the vortex-induced vibration (VIV) of a long flexible riser, subjected to two different incoming flow velocities, in experimental scale. Riser response modes and response amplitudes in in-line and cross-flow directions were obtained and compared with those of experimental and other numerical studies. A comparatively good agreement was observed. The typical vortex shedding modes, '2S', '2P', interacting with the vibration amplitude, were observed, which are visualized by the vortex particles clouds. The results of those comparisons indicate that the proposed method can be taken as an efficient computational tool to study VIV of long flexible structures.