World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

Primary Resonance in Vortex-Induced Vibration of a Pipeline Close to a Plane Boundary

Authors : Yiming Jin, Ping Dong

Abstract : The primary resonance of a pipeline close to a plane boundary is investigated in this paper. Based on classic Van der Pol equation and added a nonlinear item, a new wake oscillator model is proposed to predict the vortex-induced vibration (VIV) of a circular cylinder close to a plane boundary. Then, with the multi-scale method, the approximate solution for the case of the primary resonance is obtained. Besides, to study the characteristic of the primary resonance, the effects of the mass ration, frequency, damp ratio and gap ratio on the frequency-response curves of the pipeline are analysed. On the whole, the trend of the numerical results match up with that of the experimental data well and the mass ration, frequency, damp ratio and gap ratio play an important role in the vortex-induced vibration (VIV) of a circular cylinder close to a plane boundary, especially, the smaller is the mass ratio, the larger impact the gap ratio has on the frequency-response curves of the primary resonance.

Keywords : primary resonance, gap ratio, vortex-induced vibration, multi-scale method
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020