Abstract Submitted
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Three-dimensional simulations of flow around cylinders with fairing to suppress VIV FANGFANG XIE, Massachusetts Institute of Technology, YUE YU, Lehigh University, YIANNIS CONSTANTINIDES, Chevron Energy Technology Company, GEORGE KARNIADAKIS, Brown University — Three-dimensional simulation of stationary and moving cylinders with free-to-rotate fairings are conducted at Reynolds number $100 \leq \mathrm{Re} \leq 10{,}000$. Fairings are nearly-neutrally buoyant devices, which are fitted along the axis of long circular risers to suppress vortex-induced vibrations (VIV) and reduce the drag force. The effect of gap between fairings along the cylinder axis on the hydrodynamic forces (C_d, C_l) and the translational and rotational motion of fairings (x_{rms}, y_{rms},θ_{rms}) are investigated. With the increase of Re, the drag coefficient C_d of fairing decreases. Compared to the plain cylinder case, fairings without gap can reduce C_d by 15% while the fairing with gap can reduce C_d by almost 50%. The lift force (C_l) and angular momentum of fairing (M_{fh}) for different gaps are also decreased. Correspondingly, the vibration (y_{rms}) and rotation (θ_{rms}) amplitudes of fairing are also reduced. We also investigate the change in flow structure induced by the fairing gaps. A pair of stream-wise vortices are generated in the gap region, which extracts energy from the flow in the cross-flow direction hence causing decrease of the lift force. As Re increases, pressure recovery in the wake of the fairing is observed, which is the main reason for the substantial decrease of drag force.

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