Characteristics of Fluid Flow and Heat Transfer of a Double Wavy Cylinder

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ABSTRACT

The double wavy (DW) geometry has been initially proposed to reduce the fluid forces acting on the cylindrical structures which are frequently faced in the offshore structures. Thus, the present study aims at evaluating the performance of DW geometry as the passive control by using the numerical approach. In addition, we carry out the feasibility of this DW geometry as the heat exchanger. We consider the subcritical Reynolds number, resulting in the need of the turbulence model to close the wake turbulence. Thus, we adopt the large eddy simulation (LES). The DW geometry is based on the waviness defined by the amplitude and the wavelength. Here, the wave amplitude is fixed as 0.152 which is popularly considered in many previous studies, leading to the force reduction. The wavelength of the DW cylinder is determined by the combination of the optimal short and long wavelengths of the single wavy (SW) geometry. The optimal wavelengths in the SW geometry give the maximum force reduction. The validation has been successfully performed by the comparison with the references, which ensures the present numerical methods. Eventually, the DW cylinder achieves the force reduction. The mechanism of the force reduction is analysed by the flow structures. The DW shape attenuates the heat transfer, giving the insulation effect.