Wave-Induced Impulsive Forces in Tension Cables of a Floating Silt Curtain

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ABSTRACT

Recently silt curtains have been increasingly used at a dredging or reclaiming site in a sea for the purpose of preventing the neighbouring waters from becoming turbid. However, the hydrodynamic forces acting on such a flexible structure have not been investigated well and the design criteria have not been established. The floating silt curtain treated in this study consists of floata, tension cables and curtain canvases. The curtain canvases are hung vertically from the surface floats to the specific water depth and expanded by two horizontal tension cables both at the top and at the bottom of the curtain. When the floating silt curtain is anchored slack in regular waves, it oscillates periodically in such a way that it is pushed forward and tightened up by waves in a half period of the motion and in turn it is drawn back and tightened up again in the other half period. Large impulsive forces are observed in the tension cables at the moment when the curtain is tightened up.

This study focuses on these impulsive forces and first investigates their characteristics by physical experiments in a wave flume. A parameter which characterizes the lower limit of the occurrence of an imlpulsive force is proposed. Furthermore, a numerical model for the prediction of the impulsive tensions is proposed and compared with the experimental results. The model is based on the concept that the impulsive hydrodynamic forces are due to a sudden change in the fluid momentum, and the ratio of the momentum change is described by the deformation of the curtain. The model can explain the dependence of the impulsive forces on the representative paqrameters (such as the dimensions of the curtain and the elasticity of the tension cables), which is also observed in the experiments.

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