DREDGING DYNAMICS AND VIBRATION MEASURES

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ABSTRACT

The demands for dredging have found a profound increase in recent times. The reason for this could be attributed to growing demand for land and waterway transportation. A typical example is the Salt Lake Kolkata developed by land reclamation from maintenance dredging carried out at Hooghly River. The demand for dredging will be increasing further due to rapid urbanization and economic viability for waterway transportation. Therefore, there is growing demand for understanding the operational characteristics during dredging. As dredging is a process of excavating material from under water surface it undergoes severe vibration due to the interaction between soil-structure and water wave-structure. For that reason, there is major issue of damaging the part and decreased productivity. The same case happens for cutter suction dredger (CSD) what we are considering for recent study. In CSD the cutter damage is a major issue and the design of drive system for cutter is a challenging problem for the researchers. During the cutting operation huge amount of force and power are required. It is very important for the designers to have sufficient knowledge about the environment to operate the cutter drive system safely and economically. The present study considers the dynamic forces acting on the cutter drive during the operation. A mathematical model of the cutter suction dredger was derived using Finite element method. Two shaft having different orientations connected using a universal joint were modelled as spring elements. The shaft element consisted of five degrees of freedom per node. The effect of wave loading was calculated based on Morison equation. The inertia force contribution from the Morison equation contributes to the added mass effect on the cylindrical shaft hence influences the free vibration. The natural frequency and mode shape for a straight and shafts inclined at a specific configuration were analysed. A parametric study was carried out by varying the spring stiffness and damping, and its influence on the natural frequency and mode shape was determined.