The effectiveness of moving masses in reducing the roll motion of floating vessels - DTU Orbit (08/11/2017)

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Dynamic motions of Ships in severe conditions of sea maybe undesired and should be controlled by some devices. The rollmotion is much more significant than the other oscillations which can affect comfort, safety and efficiency of navigation at sea. This motion is controlled by some common stabilizers such as rudder, fins, etc. They may be divided into two categories of passive and active stabilizers or controllers. However controlling devices may be high in cost. Moving masses are employed to reduce the motions of floating vessels or offshore structures. This type of stabilizers consists of a mass with one or more springs and dampers. The movement of the mass produces an inertia force and moment to absorb wave excited motions. In this study the effectiveness of moving masses in vessels with large roll motion is investigated. A rolling vessel equipped with a moving mass can be modeled as a two-degree of freedom system. As in large amplitude roll motion the nonlinearities cannot be neglected, a mathematical model with second-order damping and fifth-order restoring moment is implemented as roll equation in beam waves. Applying to a Trawler, this equation is solved simultaneously with the equation of movement of the mass in both frequency-domainand time-domain by analytical and numerical approaches. The computation shows that with an optimum passive control, amoving mass with maximum 2% of the displacement of the ship is an effective device in roll minimization and enhance the vessel's stability in high load conditions.

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