

Title: **The Effect of Memory in Passive Nonlinear Observer Design for a DP System**

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Abstract

The behavior of marine structures is investigated in regular waves using various models in frequency and time domains. In normal practice, the differential form of motion equations are used with constant hydrodynamic coefficients. Those coefficients which are added masses and damping coefficients are frequency dependent due to the memory effect. The memory effects are usually represented by a convolution integral. This term makes the motion equations in integro-differential forms. This makes the equation complex and needs special attention. However, it is necessary to take into account the memory effect in ship motion control and specially in dynamic positioning system to enhance the accuracy and obtained a more precise controller. The motion equations are solved for a DP system with memory effect and compare with the conventional model. The computation shows that memory effect is important as the wave frequency increases. A nonlinear observer has been design to solve the wave filtering and state estimation problems with the memory effect. The observer has been proven to be passive and global exponential stability.

Keywords: memory effect, Time-domain model, nonlinear observer

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