

Controlled Roll Motion of Ships Using PID Controller with Actuator Delay

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Abstract-

In the event of non-linear motion of ships, the amplitudes of roll motion can have sudden jumps in a certain range of frequency. Such large amplitudes are often disastrous to the ship and can have undesired effects. These large amplitudes need to be attenuated in order to prevent undesirable consequences. Several methods are used for avoiding such large amplitudes. One such solution to decrease the large roll amplitude is to introduce fin stabilizers on either side of the ship. These fin stabilizers can function in such a way as to produce a lift which can reduce the roll moment which could have lead to the large roll amplitudes. In the paper, an attempt is done to reduce this roll motion using conventional PID controller method. The controller is applied when the roll amplitude exceeds a reference value. The PID algorithm identifies a suitable alignment for the fin such as to produce a lift required to reduce the roll amplitude. The effect of the controller on the roll motion is analyzed and compared to the normal rolling motion without the controller. Also, the controller is applied at varying time lag to study the effect of the delay in applying the controller on the resulting amplitude using an actuator delay. The different delays are compared and analyzed using numerical simulation in MATLAB.