

ANALYSIS STABILITY SYSTEM RUDDER ROLL OF SHIP CARGO A. PIONEER

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Abstract:-

Cargo Ship in dire needs good maneuverability while operating in the sea. Maneuverability is influenced by the ship's steering system which also affects the rolling stability of the ship. Rolling stability control plays an important role in the ship that can return the ship to its normal state in response to sea wave disruption, where Rudder roll is able to control the heading until the rolling motion is reduced. The disturbance used is a sea state 1 and sea state 7 in wave linear disturbances. The higher the level of interference, the longer the rolling stability reaches the steady state. The stability performance of rudder roll stabilization system has been in accordance with existing stability parameters. The maneuverability of the rudder roll stabilization system with 20° heading has an advanced distance of 275 meters in diameter.

Keywords: - Cargo Ship, Rudder Roll Stability, Heading 20 degrees, Wave Disturbances

4. Result

Analyse of Simulation Stability with 20 degree heading with no disturbance, disturbance wave sea state 1 and 7 and turning circle validation.

Figure 4.1 shows the close loop system test response for the input heading 20^0 obtained maximum overshoot of 20.2^0 , the rise time of 5 s, the settling time of 60 s, and the steady state error of 0.4. It shows that the rudder will turn 20.2^0 first before reaching the setpoint. Rudder is in a steady state with a 20^0 heading at a time of 60 seconds.

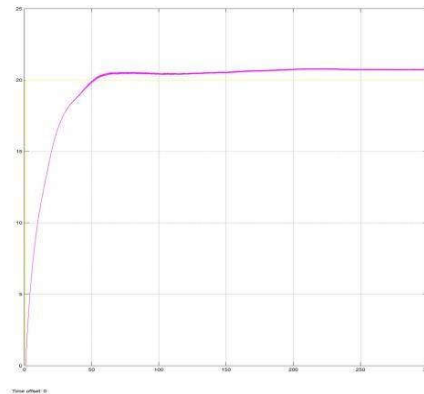


Figure 4.1 with no disturbance



Figure 4.2 with disturbance wave sea state 1

Figure 4.2 shows the close loop system test response for the input heading 20^0 obtained maximum overshoot of 20.4^0 , the increase of overshoot 7 times before reaching steady condition, the rise time of 3 s, the settling time of 70 s, and the steady state error of 0.4. It shows that the rudder will turn 20.4^0 first before reaching the setpoint. Rudder is in a steady state with a 20^0 heading at a time of 70 seconds. in Figure 4.3 shows the close loop system test response for the input heading 20^0 obtained maximum overshoot of 20.5^0 , the increase of overshoot 9 times before reaching steady rise time of 7 s, settling time of 100 s, and steady state error of 0.5. This shows that the rudder will heading 20.5^0 first before reaching the setpoint. Rudder is in steady state with 20^0 heading at 100 seconds.

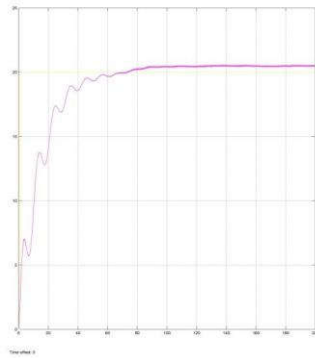


Figure 4.3 with disturbance wave sea state 7

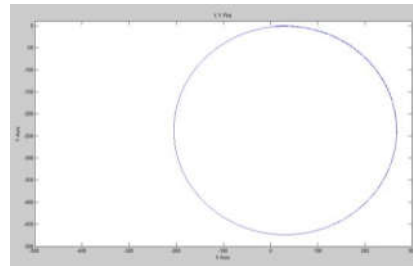


Figure 4.4 Circle Test ship stability

The higher the level of disturbance given, the greater the maximum overshoot generated. Maximum overshoot represents the first error which is the difference of setpoint and output of gyrocompass as transmitter. The addition of sea wave disruption also affects the time set. A higher the level of sea wave disruption, the longer it takes to reach the steady state. This is caused by marine wave interference that is used linearly and pushes the ship, resulting in rudder oscillation so that the longer it takes to reach steady state.

Based on the simulation results shown in Figure 4.4, the distance of the diameter of A.Pioneer's cargo ships is 275 m. The circle movement starts from the coordinates (0,0) and the time required for a single round of 360° is 225 seconds.

5. Conclusion

After designing the stability of cargo ship type A. pioneer, it can be concluded as follows:

1. Based on the performance test of ship stability with heading of 20°, with wave disturbance sea state 1 shows the presence of overshoot 7 times and settling time 70 s, whereas with wave disturbance sea state 1 produce overshoot 9 times and settling time 100 s. This shows that with the maximum disturbance of sea state 7 the performance of system stability that has been made is still stable with the maximum percentage of steady state error of 0.5.
2. The distance of diameter of A.Pioneer's cargo ship is 275 m. The circle movement starts from the coordinates (0,0) and the time required for a single round of 360° is 225 seconds.

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