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밸러스트 흘수 조건에서 MR tanker의 운전 중 프로펠러 편심 추력이 축계에 미치는 영향 연구

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Effect of propeller eccentric forces into shafting system of MR tanker in ballast condition

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To ensure the stability of propulsion shafting system, series of studies regarding shaft alignment have been performed under quasi-static conditions. In the shaft system of a ship, the increase of local load in the stern tube bearing, which supports a propeller shaft, occurs prominently due to the influence of the propeller weight at the shaft end, similar to the cantilever beam. Especially, the aft stern tube bearing is likely to receive a concentrated load in the bottom of aft side. While such magnitude and distribution of local load are determined by the relative slope angle between the propeller shaft and its support bearing, the aft bottom of aft stern tube journal bearing is more severely affected by the local load than other bearings such as intermediate shaft bearing(s). Such local load can significantly deflect towards the aft end of aft stern tube bearing in case that the shaft sags down, when the eccentric thrust force acts to the propeller shaft downward due to the propeller force in the transient status. In this context, the movement of the propeller shaft was investigated for a MR(medium-range) tanker with 50K DWT(dead weight tonnage). As a result of the evaluation, it was found that shaft movement is affected by propeller eccentric forces by the change of ship draught and main engine power. moreover, it was found that the propeller eccentric forces during vessel acceleration acted as a force lifting the propeller shaft from the aft stern tube bearing and it reduced the possibility of damage to the aft stern tube bearing, therefore, contributing to improving the reliability of the shafting system. This paper dealt with the new application of strain-gage method to evaluate the shaft stability. The research results are consistent with those from the previous studies based on the direct measurement in the vicinity of the propeller. Research findings demonstrated that this new application would be practical as an alternative to the direct measurement method performed at the propeller position. In the case of strain-gage no. 5, the elliptical circles at the ballast condition were observed. This was because the vertical and horizontal stiffness of the intermediate shaft bearing might be caused by other anisotropic supports. However, these problems are not expected to have a negative effect on the stability of the shafting system. In addition, the asynchronous imbalance state in the NCR(normal continuous condition (83 rpm) is suspected of hit-and-bounce friction phenomenon but expected to gradually stabilize aft the running in operation. As discussed before, incongruity during the analysis of the lateral vibration was not detected. In this regard, the transient condition is not expected to have an adverse effect on the shaft system in a short period of time.

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