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선박 가속이 추진축계에 미치는 영향 연구

이재웅* · 김부기** · 김연원** · 김정렬***†
*, ** 목포해양대학교, *** 한국해양대학교

Acceleration Effect on the Propulsion Shafting System of the Ship

Jae-ung Lee* · Bu-Gi Kim** · Yeonwon Kim** · Jeong-Ryul KIM***†
*, ** Mokpo National Maritime University, *** Korea Maritime and Ocean University

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It can be said that the other area that is very closely connected with shaft alignment so that it should be considered in the safety assessment of shaft is the lateral vibration of propulsion shaft system. It is better that the distance between centers of supporting bearings of the shaft system is bigger in terms of shaft system alignment, but in terms of lateral vibration, the natural frequency becomes lower so that there's a chance that resonance occurs. The research related to lateral vibration still remains as challenges due to unclear elements such as supporting bearing's stiffness in shaft system, oil film's stiffness, propeller's exciting force, etc. Therefore, until now, it only ensures if there's a sufficient margin to avoid the natural frequency of propeller blade to be within ±20% of the engine nominal speed in Classification Society, international standards, etc. Therefore, when considering such a situation, it is necessary to verify the calculation result of the natural frequency in the lateral vibration with actual measurement. In the shafting 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 propellers load at the shaft end, similar to the case of the cantilever beam. Especially, the after stern tube bearing is likely to have a concentrated load in the bottom of aft side while the forward stern tube bearing does on the bottom of forward side. While such magnitude and distribution of local load are determined by the relative inclination angle between the shaft and bearing, the bottom of aft stern tube rear bearing is affected most among them. Such local load can deflect significantly toward the aft end of aft stern tube bearing in case that the shaft sags down when the eccentric thrust force acts downward due to the propeller force in hydrodynamic transient status. The results after reviewing the stability of the shafting system of the target vessel. The calculation result of lateral vibration's natural frequency showed that resonant revolution number is located in the area of more than 163.8% compared to MCR so that it is above the limit value(±20%) and it was considered that there's no notable resonance point also in measurement analysis results. In case of 1st component of lateral vibration's revolution number, generally, it showed the constant response regardless of rpm and it's considered because of run-out value and the measured bending stress is only 10% level of provided measurement result so that a negative influence by the lateral vibration is expected not to occur. And, the shaft moment trajectory showed that slight partial friction phenomenon is estimated with 25% of engine load in strain gage position 7 so that it would be necessary to be careful of the long-time operation at 25% point to ensure the stability of shaft.

* First Author : julee.shafting@mmu.ac.kr, 061-240-7242
† Corresponding Author : jrkim@kmou.ac.kr, 051-410-4247