

Uncertainty reaction force model of ship stern bearing based on random theory and improved transition matrix method

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Abstract. Stern bearing is a key component of marine propulsion plant. Its environment is diverse, working condition changeable, and condition severe, so that stern bearing load is of strong time variability, which directly affects the safety and reliability of the system and the normal navigation of ships. In this paper, three affecting factors of the stern bearing load such as hull deformation, propeller hydrodynamic vertical force and bearing wear are calculated and characterized by random theory. The uncertainty mathematical model of stern bearing load is established to research the relationships between factors and uncertainty load of stern bearing. The validity of calculation mathematical model and results is verified by examples and experiment yet. Therefore, the research on the uncertainty load of stern bearing has important theoretical significance and engineering practical value.

Keywords: stern bearing; uncertainty model; random theory; stochastic theory; improved transition matrix method

1. Introduction

Recent years, with the development of larger modernization and automation of ship, hull deformation changes bigger than before and shaft length and diameter is becoming much larger, engine power increasing, on the other side, the number of unstable and uncertainty factors is increasing. Therefore, safety, reliability and adaptability when the shafting and stern bearing working become more and more important (Wang 2005, Geng 2010, Murawski 2005). Stern bearing is installed in tail of the ship, affected by random propeller hydrodynamic and hull deformation. Edge load effect of the stern bearing is serious, shows randomness, influence bearing's performance and life seriously. In order to adapt to the development of ship with large size, overcome design specific problems of the ship, so that the study of ship stern bearing uncertainty reaction force has important theoretical significance and engineering value.

According to the mechanism of uncertainty, there are three type models, stochastic model (Zhu 1991), fuzzy model (Cai 1990, Feng 2002) and interval model (Su 2005). Ship stern bearing which working in diverse conditions, its reaction force shows time varying characteristics due to various

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