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Mathematical Model and Algorithm of Interface Singular Stress Field of Oil-film Bearing

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Abstract：To explore the bonding performance of oil-film bearing, the mathematical model and algorithm on interface singular stress field of oil-film bearing bush was established. The oil-film pressure and oil-film temperature were calculated using finite difference method. The interface singular stress fields at the end of bearing under different conditions were calculated and analyzed: Babbitt alloy layer bonding to steel base with and without Tin as interlayer, and Babbitt alloy layer bonding to different steel base materials. The calculation results show that the interface with Tin generated higher stress singularity, which undermines the interface bonding performance. Among normal base materials, 40 steel could reduce the stress singularity effectively, therefore, it is relatively more suitable to be chosen as base material. Moreover, the mechanical model on bonding interface feature of test specimen was built according to GBT 12948-1991 Journal Bearing bi-metallic bonding strength destructive test method; the results validated the influence of temperature on singular stress field on interface end.

Key words：Oil-film bearing bush; Singular Stress Field; Tin layer; Base materials

1. Introduction

Oil-film bearing is the core load-carrying component of many kinds of key equipment, the interface bonding performance of its Babbitt layer and steel body is vital to the stable operation of devices. The bonding interface end of bearing produces stronger singular stress field under different temperature and external loads due to different physical properties of materials, which has negative influences on interface bonding performance, so it is extremely essential to explore the interface bonding performances of oil-film bearing.

Since 1970s, Bogy [1] used Mellin transform to analyze half-plane problem on different composite materials. Dundurs [2] proposed compound parameter to describe the interface mechanics property of two kinds of isotropic bi-materials, which is known as famous Dundurs parameter. Thereafter, scholars all over the world have made a lot of theoretical research on