DYNAMICS OF LIQUID MENISCUS BRIDGE OF INTERMITTENT CONTACT SLIDER

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Introduction

The flying height of a magnetic head becomes smaller rapidly and contact of the head slider with a disk surface has become inavoidable. In this headdisk interface (HDI), meniscus bridge of liquid lubricant (PFPE) is formed between the head slider and the rigid disk. The dynamic force is generated in the liquid meniscus bridge and affects the dynamics of the head-suspension assembly[1, 2] significantly.

In this study, the dynamic force between solid surfaces linked by a liquid meniscus bridge is studied analytically and its characteristics are clarified.

Models

Analytical models are shown in Figure 1. The pressure distribution in the liquid meniscus and the load-carrying capacity is derived from the Reynolds equation[3]. The boundary condition is given by the Laplace pressure[4].

Results

Assuming a small vibration of the surface separation, the pressure was found to be composed of three terms, i.e., squeeze term by liquid viscosity, spring term by kinetic Laplace pressure and static Laplace term, in all geometries shown in Figure 1. The load-carrying capacity, however, a cross term appeared in case that the solid surface has curvature.

Examples of the pressure distribution and the load-carrying capacity are shown in Figures 2 and 3, respectively, which are the case of Figure 1(d). Note that the both have negative values due to the attractive Laplace pressure. Animations of the pressure distributions will be shown at the presentation.



Figure 1 Geometry of solid surface and meniscus.



Figure 2 Pressure distribution of meniscus ring between a sphere and a plane.



Figure 3 Load-carrying capacity of meniscus ring between a sphere and a plane.

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