Maximizing minimum pressures in fluid dynamic bearings for hard disk drives.

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Fluid dynamic bearings (FDB) of hard disk drives (HDD) provide contact-free support of spinning disk packs. A simplified view of FDBs is that they are stalled viscous friction pumps: they provide pressure, but no net flow. Currently, the working fluid of FDBs is a light oil. Surface tension provides the sealing function. Most FDBs use the relative rotation of incline-grooved and smooth surfaces to pressurize the oil. As pointed out by Asada[1], groove bearings, such as herringbone-grooved bearings, create locally reduced inlet pressures, which can lead to bubble entrapment and cavitation. The problem is to shape the groove inlet to maximize the minimum pressure. To make the problem well-posed, the integral of the pressure over the bearing surface must be strictly positive.

[1] T. Asada, H. Saitou, Y. Asaida, K. Itoh, "Characteristic Analysis of Hydrodynamic Bearings for HDDs," IEEE TRANSACTIONS ON MAGNETICS, VOL. 37, NO.2, MARCH 2001, pp 801-814.