SYNOPSIS

The thesis embodies theoretical analysis and experimental study of static performance of externally pressurized oil-lubricated multirecess annular thrust bearings under central and offset loading conditions i.e. with uniform and varying film-thicknesses respectively. The bearing consists of a flat annular pad with four segment-shaped recesses which are fed with lubricant from a constant pressure source through identical compensating elements. These bearings have high load carrying capacity, high stiffness and negligible friction even at low speeds. They have also the ability to resist tilting moment under offset loading and may advantageously be used to support the turntables of heavy duty machine tools.

Theoretical analysis exists for such bearings under centra loading conditions i.e. with uniform film thickness; this analysis is based on one-dimensional flow condition assuming extension of recess pressure over the lands separating the recesses, and gives fairly accurate solution for bearings with small land-widths between the recesses but introduces appreciable error when extended to bearings with wider lands. Recently an analysis has also appeared in publication, in which the variation of pressure over the lands separating the recesses has been taken into account; this, however, gives directly the load capacity and flow requirement but not the pressure distribution.

In the present analysis, finite element method has been used to determine exact pressure distribution based on

two-dimensional flow over the bearing sill area. The pressure distribution in tilted bearings, where the pressures in the four recesses are different, has been obtained first by pressurizing each recess in turn and keeping ambient pressure in the other three recesses and the total pressure distribution has been determined by method of superposition.

Non-dimensional load capacity, flow requirement, bearing stiffness and tilting moment capacity in case of tilted bearings have been computed for bearings with a range of geometric parameters and at different intensities of compensation. Analysis has been made with capillary and orifice compensation and under two configurations of offset loading causing tilt of the bearing pad about diametral axes passing through recess centres and through land centres respectively.

An experimental set-up has been designed and fabricated and experiments have been conducted to verify the results of the theoretical analysis and the results have been found to be in fair agreement with theoretical predictions.