CHAPTER - 6

GENERAL CONCLUSIONS AND FURTHER SCOPE FOR INVESTIGATIONS

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Essentially we summarize the work presented in this dissertation. Besides we discuss general conclusions and a few related aspects where in further investigations may be carried on in this concluding chapter.

6.1 GENERAL CONCLUSIONS:

Most of the problems taken up for investigation are related either to slider bearings or squeeze film bearings.

Due to several reasons like wearing out of the surfaces due to contamination of the lubricant, long running time etc., the bearing surfaces may develop roughness on it which in turn, may affect the bearing performance considerably particularly, when the roughness becomes of the order of the lubricant film thickness. Likewise, under heavy loading the elastic deformation of the bearing surfaces may deform the lubricant film shape and affect the bearing performance.

With the development of magnetic lubricants which have found several application recently, the analysis of bearings working with magnetic lubricants has attracted good attention in the recent years.

Besides improving the performance of the bearings in terms of increase load carrying capacity etc., the use of magnetic lubricants has an important property, that the application of magnetic field keeps the magnetic lubricant intact with the bearing surfaces.
It is invariably observed that most of the bearing operate in the laminar regime. However, in the situations where in high velocities of the machine elements are involved, super laminar regime or even turbulent regime may occur. Although, much of the practice of lubrication deals with the use of non-Newtonian fluid as lubricants, most of the mathematical analysis have the base on the assumption of Newtonian fluid as lubricant. It is observed that the parameters characterizing the non-Newtonian character of the lubricant affect the performance of the bearing significantly.

In all the present investigations modified Reynolds equation governing the pressure is averaged with respect to the random roughness parameter describing the roughness in terms of mean, standard deviation and measure of symmetry. It is easily seen that while the mean and measure of symmetry can assume both positive and negative values, the standard deviation is always positive.

With regards to the transverse roughness one can visualize that all the three parameters characterizing the random roughness tend to decrease the load carrying capacity and the response time. Concerning the longitudinal roughness one can conclude from the present study that while mean and measure of symmetry cause a decrease in load carrying capacity and response time; notably standard deviation increases the load carrying capacity and the response time.

This study carried out in the present investigation reveals that the bearing suffers mostly in the case of transverse roughness. Interestingly enough the
findings say that the standard deviation improves the performance of the bearing pertaining to longitudinal roughness.

The general information is that in the case of transverse roughness the load carrying capacity and the response time decrease while coefficient of friction increases. Further, the effect of roughness on exponential slider bearing is relatively sharp.

It is noticed that the standard deviation of the roughness increases the load carrying capacity and response time while coefficient of friction gets increased in the case of longitudinal roughness. However, the effect of the mean and measure of symmetry is similar to the trends in the case of transverse roughness. Here also the effect of roughness in the exponential slider is sharper.

The study makes it clear that exponential slider bearings suffers highly in the case of transverse roughness while the standard deviation of the roughness induces strong positive effect on the performance of the exponential slider bearing. It is also observed that the effect of roughness on the plane and secant shaped bearings is nominal while the effect on hyperbolic slider is significant.

In the case of squeeze film bearing the effect of mean is considerably negative. The influence of the standard deviation in the case of transverse roughness is nominally negative while there is a substantial increase in the load carrying capacity in the case of longitudinal roughness.
The presence of magnetic fluid as lubricant improves the performance of slider bearings of various shapes such as plane slider, exponential slider, secant shaped slider and hyperbolic slider. The effect of the magnetic fluid is relatively better in the case of longitudinally rough slider bearing as compared to the slider bearings which are transversely rough. Further, by increasing the strength of magnetic field, the adverse effect caused by roughness can be reduced.

Thus, it is established that the effect of surface roughness on the performance of the bearing is significant. Because of this the effect of surface roughness on the bearing needs to be evaluated particularly when the bearing has run for considerably long time and develop roughness. Accordingly, the roughness must be taken into account while designing the bearing.

6.2 FURTHER SCOPE FOR INVESTIGATIONS:

The study of roughness incorporated in the thesis suggest us to carry out the effect of surface roughness on the performance of the other types of bearings (like gas lubricated, externally pressurized, porous bearings etc.)

It will be worthwhile to investigate the effect of roughness on the spherical bearings lubricated with magnetic fluid in general, while of particular importance can be the study on the effect of longitudinal roughness on bearings lubricated with magnetic fluid. It will be highly appealing to investigate the effect of longitudinal roughness on the performance of the bearing with sealed boundary
lubricated with magnetic fluid. The analysis presented in the thesis makes it clear that in this case the performance of the bearing may improve significantly.

In order to have a clear picture of the effect of surface roughness on the performance of a squeeze film bearing one can incorporate the measure of symmetry (besides the mean and standard deviation) and consider all other shapes. At this stage we think that a clear and precise information may emerge through the consideration of longitudinal and transverse roughness simultaneously (2-dimensional roughness). Besides precise and concrete information may be obtained by the consideration of combined roughness.

The analyses involved in the modelling of roughness and the related information indicate that the above mentioned problems may be considered in almost all forms of the bearings. This field of investigation is an area in which research frontiers may be developed in many directions.