CHAPTER-5

CONCLUSIONS AND IMPORTANT FINDINGS

From this research, it can be concluded that:

- As length to diameter ratio is increased, the value of peak pressure also increases. The pressure profile curves obtained are accurate like that of Yaacob et al. (2008) obtained curves since the mesh size selected is higher. The Yaacob’s obtained results are about 90% accurate, but the final results obtained in this research are nearly accurate. As eccentricity ratio increases, the value of peak pressure generated also increases. To avoid the danger of fluid film rupture in the clearance space, the limit is imposed on peak pressure allowable. For this, the optimum value of L/D ratio and eccentricity ratio can be given by using the graphs obtained.

- The maximum value of percentage error in attitude angle encouraged by using this method is about 4.39%. As the percentage error in attitude angle is minimum for a L/D ratio of 1, this computer aided analysis method is best suitable for designing the hydrodynamic bearing having a L/D ratio of 1.

- The computerize tool used in this study for design of bearing is unproblematic, speedy and precise to calculate the pressure profile and attitude angle.

- The obtained pressure profile is used to calculate the load carrying capacity of the bearing. The obtained value of the attitude angle is responsible for the position of minimum film thickness; hence it allows in determining the best position of the inlet oil port in the cavitations region.

- This tool is also useful for some more possibilities in changing grid size and over relaxation factor to calculate different values of pressure profiles and attitude angles.
The pressure generated inside the lubricating film of hydrodynamic journal bearing can be easily shown in three dimensional forms representing circumferential and axial pressure distribution.

This tool gives very smooth three dimensional pressure profile.

The pressure produced in the lubricating film varies with eccentricity ratio and length to diameter ratio. If we increase the L/D ratio and eccentricity ratio, the obtained pressure inside the film also increases.

The obtained pressure profile varies with grid mesh size and over relaxation factor value. Very smooth and more accurate pressure profile is obtained from mesh size of 121x41 and over relaxation factor of 1.001.

The highest peak pressure is obtained from the value of over relaxation factor of 1.001. The value of peak pressure decreases as the value of over relaxation factor increases or decreases.

The generated graphs have been obtained for attitude angle and different length to diameter ratios for mesh grid size of 121x41 and over relaxation factor of 1 and 1.001.

The variation in attitude angle when compared with Raimondi and Boyd chart (1956) is least for the mesh grid size of 121x41 and over relaxation factor of 1.001.

The value of fluid film pressure circulation was calculated by solving the governing Reynolds equation with the help of hybrid solution approach and it is also compared with the finite difference method.

If we increase the values of grid mesh size and keeping the values of the circumference and length of bearing same, the values of the dimensionless pressure profile decrease for some cases and then increase again and then again it decreases, that means it keeps on fluctuating.

If the values of circumference, length of bearing and grid mesh size are kept constant, the values of dimensionless pressure profile increases.

If the values of the circumference and length of bearing are same and grid mesh size is kept constant with the increased accuracy level, higher values of the dimensionless pressure profile are obtained.

In the present study, operating parameters were calculated by the pressure distribution obtained. In this approach finer mesh size are used to get more precise results. It can be concluded that variation of pressure distribution is dependent on grid mesh size, circumference and length of bearing. As the level of accuracy is increased, better
distribution of pressure is obtained. It is also observed that, the hybrid solution approach proposed in this study can precisely and efficiently calculate the operating characteristics of a journal bearing.

- Thermo-hydrodynamic analysis has been done to calculate the average temperature of the oil film at steady state condition, which comes nearly equal from software and from the analysis also. This concludes that the result of the analysis is validated with the analytical solution. The difference in temperature is due to the assumption in analytical theory that viscosity is not changing with the rise in temperature. Heat generation within the bearing is calculated by the numerical techniques, which is also approximately close to the analysis result and with the experimental result also. The rise in temperature within the bearing is due to increase in the speed and load. The graphical relation between the friction coefficient and Sommerfeld Number are given. The relation between the effect of the heat generated and average film temperature is given in this paper. Average film temperature is calculated and the pressure profile obtained at this temperature is very close to the real condition.