NAME OF THE SCHOLAR: **ALI KAMIL JEBUR**
NAME OF SUPERVISOR: **PROF. I. A. KHAN**
NAME OF CO-SUPERVISOR: **PROF. Y. NATH**
DEPARTMENT: **MECHANICAL ENGINEERING**
TITLE OF THE THESIS: **SOME STUDES ON THE STABILITY AND NON-LINEAR DYNAMIC CONTACT BETWEEN ROTATING SPUR GEARS**

ABSTRACT

Gears are the most widely employed mechanical components in space and surface vehicles. Therefore in order to achieve better efficiency and smooth operation, there is a need to develop better analytical and experimental techniques for the study of gear characteristics. This thesis is an effort to investigate the characteristics of an involutes gear system including bending and contact stress, maximum displacement, dynamic analysis (transient response) and gear stability.

Classical method for calculating contact stress, in gears is based on Hertz's equation. To enable the investigation of contact problems with Finite Element Method (FEM), the stiffness relationship between the two contacting areas is usually established through a spring placed between them. This can be achieved by inserting a contact element placed between the two areas where contact occurs. A computer program has been developed using MATLAB program. The results of the two and three dimensional FEM analyses using ANSYS program (surface to surface contact model) for polyimide materials are presented. The numerical results of dynamic contact stress of two dimensional are compared with the theoretical values (Hertz's

equations); also the results of two dimensional are compared with three dimensional. Both results agree quite well. This indicates that the Finite Element Method (FEM) model ANSYS program (surface to surface contact model) for two dimensional is accurate more than ANSYS Program (point to point contact model) for two dimensional and the results obtained by Hertz's equations because it is very near to the reality. Also the difference of the results for dynamic contact stress between two and three dimension is very small (8.32 %).

An experimental set up is designed and employed for the dynamic contact stress by using strain gage implanted inside the gear tooth made of polyimide materials and D.C. servomotor is used to rotate the system. Comparison of results between (3D) surface to surface contact model (ANSYS program) and experimental investigations has been made and found that both results agree quit well with a maximum difference of 13%.

Influence of pressure angle, number of teeth, and module on the contact stress, bending stress, normal displacement, natural frequency, static, free vibration and transient response analysis of spur gears have also been studied. Employing the root locus and step response, the stability of the spur gears is also investigated by using MATLAB program.