ABSTRACT

The motivation for the present work lies in the fact that the design of drive housings depends on a large number of parameters. The usage of traditional parametric studies by changing one factor at a time is not sufficient for design evaluation of drive housings. The need of dynamic analysis to investigate the effects of combination of several factors on housing design and its interactions is very much required to help improve the design of drive housings. In this thesis, a new approach based on dynamic analysis to investigate the effects of introduction of ribs, stiffeners and cutouts used in design of drive housing in many engineering fields is conducted.

A review of available literature on transmission housings with specific reference to structural vibration, chatter analysis and noise radiation is presented in this thesis. Housings include gear boxes and structures supporting other transmission elements like Vee pulleys, impellers and motor shafts. Analytical and experimental methodologies reported in the recent past for strength, vibration and noise analysis, mounts and suspension, structural optimization, overall drive and housing systems are presented. Typical design guidelines, as outlined by various investigators, are also included.

Fabricated housings of various drives (Transmission and Gear housings) undergo structural vibrations during their operation. Dynamic
analysis of such housing is required in order to avoid operating them at near resonant conditions. In this research work initially the dynamic analysis is carried out on simple housings which are considered as rectangular boxes. Finite Element Method (FEM) is used to determine the natural frequencies of the boxes. Rayleigh’s energy method is employed to establish the efficacy of the bending mode results obtained by FEM. Experimental verification is also carried out on fabricated transmission housing. In addition, with specific reference to heavy engineering industries, the study using Finite Element Method is extended to include housings with rectangular and circular cutouts and reinforcing ribs and stiffeners of standard sizes for the power range 1 to 4500 kW (6000 hp) and output speed range from 1 to 1500 rpm. The research covers the major design parameters in housings like length, breadth, height and thickness including the influence of ribs and stiffeners. The results of this study can used to provide design guidelines for industrial drive housings by integrating the knowledge in machine element design, finite element method and vibration practice.