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Vibration Analysis of the Platter and the Spindle Assembly of Hard Disk Drive

A thesis submitted to the faculty of Massey University in partial fulfilment of the requirements for the degree of Master of Engineering in Mechatronics

By

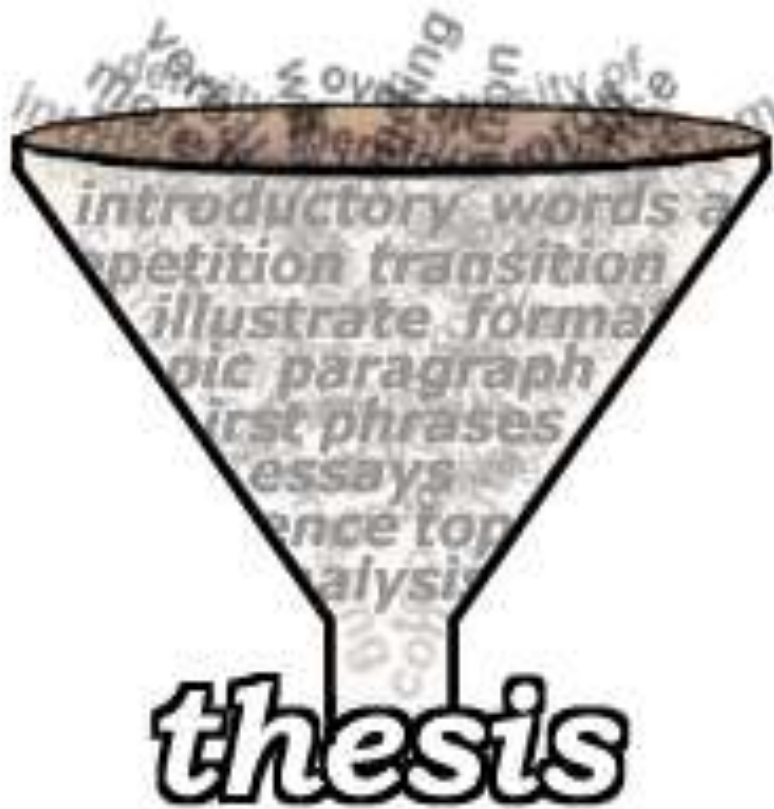
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I would like to start my thesis with the following quote;

“Knowing is not enough; we must apply. Willing is not enough; we must do.”(Johann Wolfgang von Goethe)

Before starting my research I had knowledge but did not know when and where to apply. After going through all the tough times throughout my research I have learnt how to use your knowledge. Even if you have little knowledge you must know how and where to apply.

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Abstract

As the demand for higher data transfer rate in a hard disk drive (HDD) has increased, faster rotational disk speed has been imposed. Unfortunately, higher rotational disk speed leads to higher vibration and that leads to high frequent track misregistration (TMR). In order to solve this problem, a new damping system has been suggested that will help to reduce vibration in high speed hard disk drives.

The thesis contains a detailed study of vibration and its types. Causes of vibrations have been discussed too.

The thesis also contains a study of vibration and its effects on rotating disc such as HDD Platter. Detailed vibration analysis was performed on the HDD platter and spindle-assembly so that natural frequencies of all vibrational modes can be calculated.

Research includes, the thermal analysis of spindle disk assembly used in computer hard disk with new design approach of spindle to minimize the repeatable run-out (RRO) of track following position error signal (PES) in high track per inch (TPI) disk drives.

The thesis proposed a simple but analytical approach for the design of HDD enclosure with different sector shapes and for the spindle motor with different slot/notch angles, based on the analysis and simulation results.

Based on the simulation and experimental results, the proposed method can be introduced as a very promising tool for the design of HDDs and various other high performance computer disk drives such as floppy disk drives, CD ROM drives, and their variations having spindle mechanisms similar to those of HDDs.

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