

**AN INVESTIGATION INTO THE WORKPIECE  
ACCURACY IN CYLINDRICAL GRINDING**

**BY**

**AHMAD AFSARI**

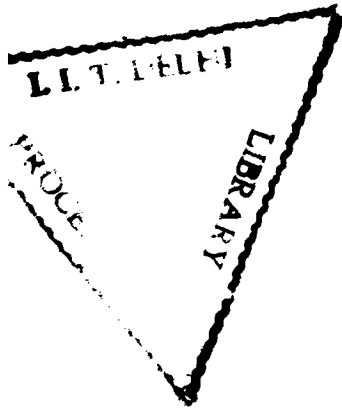
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## **CERTIFICATE**

This is to certify that the thesis entitled "**AN INVESTIGATION INTO THE WORKPIECE ACCURACY IN CYLINDRICAL GRINDING**", being submitted by **Mr. AHMAD AFSARI** to the Indian Institute of Technology - Delhi, for the award of the degree of **Doctor of Philosophy** is a record of bonafide research work carried out by him. He has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which to my knowledge, has reached the requisite standard. The results contained in this thesis have not been submitted, in part or full, to any other university or institute for the award of any degree or diploma.



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The accuracy of components produced by precision grinding depends upon various parameters and a detailed investigation would need to cover a number of fields, including the geometrical accuracy of the machine parts, relation between the variables of the cutting process, the compliance of the Machine-Fixture-Workpiece-Cutting Tool (MFWT) system, deflection of the machine parts by the rise in temperature, etc..

Workpiece deflection due to grinding force is one of the major factors influencing the size accuracy of the ground workpiece. This investigation presents a study of deflection of the workpiece due to the resultant tangential and radial grinding forces. Analysis of the workpiece deflection due to applied load has been carried out using the classical theory as well as by finite element method (FEM).

The compliance of MFWT elastic system is the prime factor influencing the design of high precision machine. In this study, the compliances of the headstock, the tailstock and the wheelhead spindle of cylindrical grinding machine are determined experimentally, with a view to understand the relative importance of the contributing factors to the compliance of the system and thereby the accuracy of the components produced on the machine. The experimental work was carried out on two different types of cylindrical grinding machines.

The errors in the alignment of a machine tool due to thermal distortion of the machine, are often significant in comparison to the specified limits of tolerance of the alignment of the machine. Therefore, it was considered necessary to understand the thermal deformation behavior. In order to find out the nature and behavior of different sources of heat and also their effects on dimensional accuracy, surface integrity and surface finish of the workpiece, experimental investigation has been carried out regarding i) Identification of

different sources of heat generation, ii) Determination of temperature rise in different parts of the machine and iii) Determination of the deflection of different parts of the machine due to the rise in temperature.

Finally, the total error due to deflection of the workpiece, compliance of the headstock, the tailstock, and the grinding wheelhead on the accuracy of the workpiece for particular cases are calculated and the surface roughness and shape error are measured.

The results obtained by the experimental and analytical investigations are analyzed to provide additional knowledge for improving the accuracy of the workpiece in cylindrical grinding.

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