AN INVESTIGATION OF SOME TRANSVERSE ROLLING PROCESSES

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By
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CERTIFICATE

This is to certify that the thesis entitled, "An Investigation of Some Transverse Rolling Processes", being submitted by Mr. Sayed Mohd Haider to the Indian Institute of Technology, Delhi for the award of the degree of 'Doctor of Philosophy' in Mechanical Engineering 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 has reached the requisite standard.

The results contained in this thesis have not been submitted in part or in full to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

An investigation of transverse rolling process, undertaken in this study, will lead to proper design and development of machines required for making various axi-symmetric products such as discussed in this thesis.

Chapter-1 of the thesis deals with the importance of transverse rolling process. Brief history of transverse rolling process, theory of metal forming and related concepts have been dealt in detail.

The entire thesis deals basically with three specific uses of transverse rolling (i) rolling of edges of strips with flat rolls, (ii) rolling of circular discs with flat rolls and (iii) rolling of edges of strips with triangular edged rolls. All these experimental processes have been analysed theoretically.

Chapter-II deals with experimental work of rolling the edges of strips with flat rolls. A review of those transverse rolling processes using similar process as used in this chapter, have been made. This chapter gives full details of experiments which include constructional and functional details of the machines. Observations have been made to study the effects of roll penetration and thickness of specimen being rolled, on rolling loads.

Chapter-III deals with theoretical analysis of edge rolling process. An upper bound approach has been followed with

some simplifying assumptions. The theory has been developed to predict the effects of roll penetration, roll diameter, thickness being rolled, on rolling load. Deformation pattern has been studied by making the grids on a cross-section of a strip. The effect of rolling on the hardness of the rolled surface have also been observed. Analytical results have been compared with theoretical results, which were found to be following the same trend as the experimental, but quantatively some differences were there.

Chapter-IV deals with experiments performed for rolling edges of circular discs on a transverse rolling machines. With the help of these experiments the trend of variation of rolling forces torque and shoulder length with the variation in depth of penetration, rolling thickness etc. have been established.

Chapter-V describes theoretical work done by various authors for this type of rolling. Analytical formula has been derived using upper bound theorem to predict the effects of various connected parameters on rolling load and shoulder length. The optimum shear angle is calculated by minimising the total rate of energy distribution. Trend of variation of rolling load and torque with variation in rolling thickness, roll diameter, specimen diameters, material work hardening has been established theoretically. Theoretical results have been compared with the experimental results arrived in Chapter-IV and were found to be in agreement to a large extent.

Circular disc or strips having V-shaped edges have considerable utility in various industrial applications. Chapter-VI deals with investigations of such a process. In Chapter-VI this process has been visualised by pressing the edges of strip by triangular straight dies. Efforts have been made to study the effect of wedge angles, strip thickness on the deforming load. Under bound technique has been used to predict rolling force and deformed shapes. Experimental results for pressing strip edge with triangular straight dies have been compared with those arrived theoretically and have been found to be in conformity to a large extent.

In Chapter-VII, the achievements of various experiments and theoretical analysis discussed in this thesis have been summarised. Scope of further work has been briefed. In the end list of references, computer programme and other annexures have been given.

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