AN ANALYSIS OF RESIDUAL STRESSES
DUE TO THE GRINDING PROCESS

by

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A thesis presented to the
Indian Institute of Technology, Delhi
for the award of Degree of
Doctor of Philosophy.

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March, 1976.

To my wife,

Dr. (Mrs.) Shakuntala Mishra.

ABSTRACT

An analytical model has been proposed for determining residual stresses of thermal and mechanical origin due to surface grinding. The grinding process has been taken to be equivalent to the case of a moving force and a moving heat source, both distributed over the contact area between the grinding wheel and the work piece.

The finite element method has been employed for determining the elastic-plastic state of stress within the workpiece. Changes in mechanical behaviour and thermal properties with temperature have been incorporated in the analysis. An iterative procedure was employed for the step-by-step movement of the temperature field and the force in order to simulate the movement of the grinding wheel over the workpiece. The elastic-plastic stress history has been computed culminating in the residual stress state of the workpiece.

An adequately sensitive bending-deflection technique has been employed for the determination of the residual-stress distribution under some typical conditions of surface grinding. The experimentally determined stress distribution was compared with those obtained analytically.

The effects on residual stresses of the thermal and mechanical loads have been separately determined with the help of the analytical model and it has been shown that the mechanical force in grinding has negligible contribution.

The influence on residual stresses of processing parameters such as speed, feed and depth of cut have also been explained.

CERTIFICATE

This is to certify that the thesis entitled "An analysis of residual stresses due to the grinding process" by Ashutosh Mishra has been prepared under my supervision in conformity to the rules and regulations of the Indian Institute of Technology, Delhi. I further certify that the thesis has attained a standard required for a Ph.D. degree of the Institute. The research report and results presented in the thesis have not been submitted for any degree in any University.

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ACKNOWLEDGEMENTS

I wish to express my profound gratefulness to Professor U.R.K. Rao, Department of Mechanical Engineering, for the guidance and encouragement he rendered at every stage of this work, without which this work would not have been possible.

I also wish to thank Dr. R. Natrajan, Applied Mechanics Department, for giving very generously his time and help during the development of the computer programme.

Thanks are also due to Mr. M.M.K. Verma and Mr. I.R.Mendiratta of Mechanical Engineering Department for their assistance in the laboratory.

My sincere thanks go to Mr. B.L. Tuli for typing the thesis.

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CONTENTS