

ELASTO-PLASTIC ANALYSIS OF GRINDING PROCESS
IN PRESENCE OF CRACK

by

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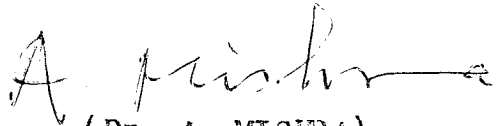
WHO

INSPIRED

C E R T I F I C A T E

I am satisfied that the thesis presented by Fuleshwar sinha entitled "Elasto-Plastic Analysis of Grinding Process In Presence of Crack", is worthy of consideration for the award of the degree of Doctor of Philosophy and is a record of the original bonafide research work carried out by him under my guidance and supervision and that the results contained in it have not been submitted in part or full to any university or institute for the award of any degree or diploma.

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ABSTRACT

A semi-analytical finite element model has been presented to study the influence of residual stresses caused by grinding process on the fracture behaviour of ground specimen.

The problem of sharp cracked rectangular plate has been selected for the analysis. For developing the finite element model, a test problem of semi-infinite crack in an infinite plane has been successfully analysed by considering a finite region centered at the crack tip giving displacements at the boundary from Westergaard solution. Crack tip as well as isoparametric elements have been used in elastic and elasto-plastic case throughout the analysis. Crack tip elements were of definite advantage in reducing the number of elements near the crack tip. The crack tip elements incorporate the singularity effect at and near the crack tip region.

The same finite element model have been used for analysing single edge cracked rectangular plate for elastic and elasto-plastic plane strain condition. The variation of residual stresses due to mechanical load in the crack tip region has been found by using this model.

A separate finite element model has been developed for the analysis of residual stresses due to surface grinding

process for elasto-plastic case using Carslaw and Jaeger's moving heat source analysis. The magnitude, nature and depth of distribution of residual stresses obtained from the model have been verified from the experimental results employing bending deflection technique.

Experimental results of Mouth Opening Displacement (MOD) value for unground and ground specimens under uni-axial loading as well as three bend test have been presented in the thesis. The fractographs of the fractured surfaces taken on Scanning Electron Microscope have been included.

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