World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:9, No:01, 2015

Experimental and Numerical Investigation of “Machining Induced Residual Stresses” during Orthogonal Machining of Alloy Steel AISI 4340

Authors : Theena Thayalan, K. N. Ramesh Babu

Abstract : Machining induced residual stress (RS) is one of the most important surface integrity parameters that characterize the near surface layer of a mechanical component, which plays a crucial role in controlling the performance, especially its fatigue life. Since experimental determination of RS is expensive and time consuming, it would be of great benefit if they could be predicted. In such case, it would be possible to select the cutting parameters required to produce a favorable RS profile. In the present study, an effort has been made to develop a 'two dimensional finite element model (FEM)' to simulate orthogonal cutting process and to predict surface and sub-surface RS using the commercial FEA software DEFORM-2D. The developed finite element model has been validated through experimental investigation of RS. In the experimentation, the orthogonal cutting tests were carried out on AISI 4340 by varying the cutting speed (VC) and uncut chip thickness (f) at three levels and the surface & sub-surface RS has been measured using XRD and Electro polishing techniques. The comparison showed that the RS obtained using developed numerical model is in reasonable agreement with that of experimental data.

Keywords : FEM, machining, residual stress, XRF
Conference Title : ICAME 2015 : International Conference on Automotive and Mechanical Engineering
Conference Location : Zurich, Switzerland
Conference Dates : January 13-14, 2015