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Numerical simulation of the effects of elastic anisotropy and grain size upon the machining of AA2024
(2018) *Machining Science and Technology*, 22 (3), pp. 522-542. Cited 2 times.

Abstract
Turning modeling and simulation of different metallic materials using the commercially available Finite Element (FE) softwares is getting prime importance because of saving of time and money in comparison to the costly experiments. Mostly, the numerical analysis of machining process considers a purely isotropic behavior of metallic materials; however, the literature shows that the elastic crystal anisotropy is present in most of the 'so-called' isotropic materials. In the present work, the elastic anisotropy is incorporated in the FE simulations along with the effect of grain size. A modified Johnson-Cook ductile material model based on coupled plasticity and damage evolution has been proposed to model the cutting process. The simulation results were compared with experimental data on the turning process of Aluminum alloy (AA2024). It was found that the elastic anisotropy influences the average cutting force up to 5% as compared to the isotropic models while the effect of grain size was more pronounced up to 20%. © 2018 Taylor & Francis Group, LLC.

2-s2.0-85042233006
Document Type: Article
Publication Stage: Final
Source: Scopus