

Finite Element Modeling of Ultrasonic Shot Peening Process using Multiple Pin Impacts

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Abstract : In spite of its importance to the aerospace and automobile industries, little or no attention has been devoted to the accurate modeling of the ultrasonic shot peening (USP) process. It is therefore the purpose of this study to conduct finite element analysis of the process using a realistic multiple pin impacts model with the explicit solver of ABAQUS. In this paper, we research the effect of several key parameters on the residual stress distribution within the target, including impact velocity, incident angle, friction coefficient between pins and target and impact number of times were investigated. The results reveal that the impact velocity and impact number of times have obvious effect and impacting vertically could produce the most perfect residual stress distribution. Then we compare the results with the data in USP experiment and verify the exactness of the model. The analysis of the multiple pin impacts data reveal the relationships between peening process parameters and peening quality, which are useful for identifying the parameters which need to be controlled and regulated in order to produce a more beneficial compressive residual stress distribution within the target.

Keywords : ultrasonic shot peening, finite element, multiple pins, residual stress, numerical simulation

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