

# **FINITE ELEMENT SIMULATION OF RESIDUAL STRESS PROFILES IN PEEN FORMING PROCESS**

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## **ABSTRACT**

Shot peening process can induce the distortion of a thin component, which is called peen forming and is widely used for shaping aircraft wing skin. In peen forming process, a component is rigidly constrained during shot peening. As peening take place, gradual plastification of the component surface layers produces induced stress profiles. These induced stresses are not self-equilibrated and tend to stretch and bend the component. Therefore, after release of the boundary conditions, the component deform to designed shape. The advantages of peen forming are it is a dieless forming process, and it causes compressive residual stresses both at the top surface and at the bottom surface of the component, which can greatly improve the fatigue life of the component. In practical peen forming stress, shot peening intensity, shot peening coverage, impact angle and pre-bending moments are the most important parameters to control forming results (deformed shape and residuals stress profiles). Due to the insufficient investigation of these control parameters, the design of peen forming for a specific shape has been based on experimental trial and error. The objective of this paper is to simulate the real shot peening and peen forming process and relate the forming results with shot peening parameters. A newly developed 3D finite element model with multiple random shots together with an Implicit-Explicit sequence solution has been developed to simulate conventional peen forming and stress peen forming process.

## **KEY WORDS**

Finite element method, Induced stress, Residual stress Conventional peen forming, Stress peen forming,