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Numerical Simulation of Contact Spring Blanking Process

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Summary

Contact spring is used as a electric contact in mobile phone. As downsizing of mobile phone, size of contact spring also becomes very small. Generally, the thickness of it is under 0.12 mm. This small part is made of blanking. It is well know that residual stress is generated by blanking process. As contact spring is very small, the residual stress by blanking process may have large effect of the mechanical behavior of this part, which affects the performance as an electric contact. In many industrial structures, compressive residual stress is effective to protect from fatigue damage. In this meaning, it is important to understand how residual stress is distributed in contact spring after blanking. Based on these backgrounds, blanking process is simulated numerically and distributions of residual stress are evaluated.

For the simulation of blanking, large plastic deformation and fracture process should be evaluated. For this purpose, Gurson's constitutive equation for voided material is introduced in FEM analysis. By using this constitutive equation, large deformation and ductile fracture can be estimated by a single parameter f, void volume fraction. This equation has been successfully used by several authors for blanking simulation [1, 2]. Updated Lagrangean method is used for large deformation analysis. As the shape of contact spring is complicated, FEM data becomes huge, and parallel computing is needed for numerical simulation.

At first, two-dimensional blanking simulation was conducted. Blanking process of thin plate is simulated, and effects of clearance on residual stress distribution and on punching force are evaluated. Then three-dimensional simulation is conducted for real contact spring blanking. Contact spring blanking is composed of two major processes. They are called step A blanking and Step B blanking. The effect of the order of these steps on residual stress distribution is studied. The effect of clearance on residual stress field is also studied. Finally, optimization of contact spring blanking is proposed and discussed.

References

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