

# A method for prediction of $S-N$ curve of spot-welded joints based on numerical simulation

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## ABSTRACT

Currently,  $\Delta F-N$  curves are often used to predict the fatigue lives of spot-welded joints, but the method for obtaining these  $\Delta F-N$  curves is time-consuming, laborious, and non-universal. Tensile-shear fatigue tests were performed to obtain the fatigue lives and the corresponding normalized  $S-N$  curves of spot-welded joints. Subsequently, the force acting at the spot-welded joints was obtained by extracting the force and moment of the beam element in the shell-element-based finite element model, and the equivalent structural stress at the spot-welded joint was obtained based on the equivalent structural stress method. Finally, the  $S-N$  curves of the spot-welded joints were fitted using the least-squares method. A comparison of the  $S-N$  curves of the spot-welded joints with those of different materials revealed that the material type had a significant influence on the  $S-N$  curve. To avoid this influence, a method for predicting the  $S-N$  curve of the spot-welded joints was proposed based on the relationship between the ratio of the tensile strength and that of the fatigue limit of each material. This research provides guidance for predicting the fatigue life of spot-welded joints in engineering applications.

## ARTICLE INFO

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