Numerical simulation and experiments analysis on stiffness control mechanism of hyperboloid shallow shells

Zhao Lihong, Harbin Engineering University; Yu Haiping; Xing Zhongwen; Lei Chengxi; Harbin Institute of Technology; Wu Bin, Harbin Engineering University

ABSTRACT

The experiment and simulation on stiffness of hyperboloid shallow shells have been performed. The sequential processes, including sheet metal forming, springback, and stiffness test of hyperboloid shallow shells, are investigated through FEM numerical simulation. The reliability of numerical simulation results on stiffness test of hyperboloid shallow shells is enhanced and validated by experiment. The analysis and control of the panel stiffness can be attained by the distribution of strain and stress after forming, springback, and stiffness test, under varied blank holding force. The smaller the residual stress is, the greater the stiffness is, and the uniform distribution of residual stresses on the centre of panel is beneficial to increase the stiffness. The Young’s modulus of material properties plays a great role on the shell stiffness, and the stiffness increases with increasing of Young’s modulus. Also, the effect of strength coefficient on the stiffness is obvious in the mechanical properties. All results will provide a particularly effective process guidance and technical approach in the automotive panel production

KEYWORDS: numerical simulation, automotive panel, stiffness, material properties, forming process