Analysis and Simulation of Springback for Sheet Metal Hydraulic Forming Processes

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ABSTRACT

The main object of this investigation is to derive an efficiently analytical model to predict the springback of sheet metal forming by rubber-pad forming processes. A computer program was developed to predict the springback by the analytical mathematic model and optimization techniques for fitting models of nonlinear material properties of aluminum. This program could offer the manufacturing industry to obtain the fitting function of nonlinear materials and springback angle of bending. The hydraulic forming and rubber-pad press forming methods, which are the most common methods in the manufacturing industry of aviation, were studied in this research. Meanwhile the most common used heat treatment aluminum alloy of aviation field 2024-T3, 7075-T4 and 6061-T4 were adopted in this investigation. Hence, the investigation discussed all the manufacturing parameters of the bending sheet metal parts during the bending procedure, which influence the springback. The relationship between the springback and (1) material properties, (2) material thickness, (3) bending radius, (4) bending angle, (5) length of flange, (6)bending rate and (7) working pressure etc. were already discovered to discuss extensively, and also search the correction factor for the modification of the sheet metal forming die. In the research, the commercial finite element package, ANSYS, was also applied to simulate the forming processes of the sheet metal parts and was compared with experiment data and the analytical model results. To evaluate the results proved the analytical model which is efficient and accurate and also provide the design engineer a good molding tool to design a good sheet metal forming die and shorten manufacturing hours.

Keywords : hydraulic press forming ; rubber-pad forming ; springback ; sheet metal ; finite element method

Table of Contents

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