Title:
Experimental and numerical investigation of the influence of forming parameters on deep drawing operation of metal/polymer/metal rectangular three layers sheet

Abstract:
Multi-layer-metal-composites have many applications in the defense industry, aerospace and automotive industries respectively. The unique features of composite materials such as high strength-to-weight ratio, improved vibration damping without adding extra weight to the structure, good properties of the material to absorb shock and energy, and other special applications of these materials, caused the increasing use of and research on these products. In this thesis, the deep drawing process of multilayer composite aluminum / polyethylene / aluminum sheets has been studied experimentally and numerically. For this purpose, at first the deep drawing process of the sheet was simulated by Abaqus finite element software. In the following, rectangular deep drawing process mould was built and after preparing a three-layer plate, deep drawing was performed on it by hydraulic press machine and the effects of parameters such as, blank holder Force, lubricant, and film thickness on the wrinkling rate of a three-layer sheet was evaluated. Preparation of three-layer sheet was associated with a hot die under pressure. All of the items that were studied empirically were also examined by simulation software in which the mechanical properties were obtained by standard tensile test, and finally results were compared and validated that the integration was well between them. Results showed a significant reduction of wrinkles caused by increasing of blank holder force. And it was found that the use of lubricant between the blank holder and sheet will followed by the lack of ruptures even in the force of 3000 Newtons by blank holder. The effect of different thicknesses of the layers was also another part of the survey results that indicate a reduction in three-layer sheet wrinkles by increasing the thickness of aluminum on both sides.

Keywords:
deep drawing, rectangular, three-layer sheet, wrinkling, Abaqus, blank holder force