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The Influence of Punch Profile Radius on Deep Drawing Process in Case of a Low Carbon Steel Cylindrical Cup

Abstract - This research aims to investigate the effect of punch profile radius on the drawing force, cup wall thickness, amount of spring back induced in the drawn cup, contact regions between blank and punch, strain distributions over the cup wall and height of drawn cup, in deep drawing operation. In this study, a commercial FEA software package (ANSYS11.0) was employed to model a deep drawing operation. A 3-D model of cylindrical cup of (53.4 mm) outer diameter and (33mm) height from a low carbon steel (1008–AISI) of (0.7mm) sheet thickness has been developed and then the FE simulations results are compared with experimental results. To carry out the experimental work, six types of punches of (52mm) diameter with various punch profile radius of (4, 8, 12, 16, 20, 26 mm), die of (53.75mm) die opening diameter with die profile radius of (4 mm) and blanks of (95 mm) diameter have been manufactured. The results indicate that the strain distributions for all punches chosen are similar in shape, and have the same trends. The length of contact distance between the punch and blank increases as the punch corner radius increases and its value approximately is equal to punch corner radius. Drawing force dose not significantly influence by punch corner radius. Thinning increases as punch profile radius increases, and the greatest thinning occurs with the hemispherical punch of ($R_p= 26\text{mm}$). The cup height and the amount of spring back percentage increases as punch profile radius increases.

Keywords - Contact Regions, Deep Drawing, Punch Profile Radius, Spring Back.

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