Experimental modeling of fluid pressure during hydroforming of welded plates

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A B S T R A C T

The procedure of hydroforming belongs to one of the modern methods of sheet and tube design, usually of complex configuration. Research in the field of plastic forming using fluids usually relates to the analysis of important parameters that would enable high-quality design of elements and execution of the process in stable conditions. The hydroforming process of welded sheets found its application in manufacturing of tanks and other sheet parts in automotive industry, where, in addition to technical and technological characteristics of the obtained piece, it is necessary to achieve stability of the process and its economic feasibility. Experimental research in this paper had been aimed at the analysis of results and modeling of working fluid pressure during hydroforming of welded sheets of two kinds of material (St 37 and Al 99.5) for two sheet thicknesses (1.5 mm and 2.0 mm). Modeling was done by regression method, whose analysis is the determination of functional relationships between a dependent variable and two independent variables. Application of mathematical modeling method enabled working fluid pressure which confirmed the impact of input variables of hydroforming process (yield strength and sheets thickness) onto the values of working fluid pressure. Experimental results obtained for working fluid pressure enabled easier planning and projection of hydroforming process.

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Eksperimentalno modeliranje tlaka tekočine med hidroformiranjem zvarjenih plošč

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POVZETEK

Tehnika hidroformiranja sodi med moderne metode oblikovanja pločevine in cevi, navadno kompliciranih oblik. Sodobne raziskave na področju plastičnih preoblikovanj se nanašajo na analize pomembnih parametrov, ki zagotavljajo kakovosten dizajn elementov in izvedbo procesa pod stabilnimi pogoji. Hidro-formiranje se uporablja pri proizvodnji avtomobilskih rezervoarjev in drugih komponent v avtomobilski industriji, kjer je poleg tehničnih in tehnoloških karakteristik pridobljenega izdelka potrebno upoštevati tudi stabilnost in ekonomičnost proizvodnega procesa. V eksperimentu smo obravnavali različ-ne delovne tlake tekočine za hidroformiranje zvarjenih pločevinastih plošč iz dveh različnih materialov (St 37 in Al 99.5) pri dveh debelinah (1.5 mm in 2.0 mm). Funkcijsko odvisnost med obema odvisnima in neodvisno spremenljiv-ko smo dobili z regresijsko analizo. Z matematičnim modeliranjem smo potr-dili vpliv vhodnih spremenljivk hidroformiranja (natezna trdnost, debelina pločevine) na vrednosti delovnega tlaka tekočine. Pridobljeni eksperimentalni rezultati za delovni tlak tekočine omogočajo lažje načrtovanje in projekcijo procesa hidroformiranja.