

Reversible and Irreversible Wrinkling in Tube Hydroforming Process

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Abstract : This research aims at analyzing and optimizing the hydroforming process parameters to achieve a sound bulged tube without failure. Theoretical constitutive model is formulated to develop a working diagram including process window, which represents the optimize region to carry out the hydroforming process and predict the type of tube failure during the process accurately. The model is applied into different bulging ratios for low carbon steel (C1010). From this study, it is concluded that the tubes with bulging ratios up to 50% and 70% are successfully formed without defects. The tubes with bulging ratio of 90% are successfully formed by hydroforming with optimized the loading path (axial feed versus internal pressure) within the process window. The working diagram is modified due to different types of formation of wrinkling during the hydroforming process. The formation of wrinkles with increasing axial feed can be useful in terms of the achievement of higher bulging ratio and/or less thinning and this type of wrinkles can be overcome through the internal pressure in the later stage of the hydroforming process. On the other hand, the formation of wrinkles may be harmful, if it cannot be reversed.

Keywords : finite element, hydroforming, process window, wrinkling

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