

Application of special finite element technology for modeling the clinching process

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Abstract. Mechanical clinching process is recognized as an industrial technique to join dissimilar metal sheets by cold forming. In this technique, the metallic layers are joined by local hemming with a punch and die [1]. The present paper aims at providing a finite element framework for the modeling of mechanical clinching processes. To accomplish this, a locking-free element formulation (Q1SP) based on reduced integration with hourglass stabilization is employed [2]. First, a short description regarding the element formulation is given. Then, it is shown that the Q1SP element can efficiently reproduce the large plastic deformations observed within the clinching process (see Figs. 1 and 2). Additionally, the performance of the employed element is compared with the standard Q1 element. It is shown in the numerical example that the standard Q1 element exhibits an artificial stiffness due to the locking phenomenon which may result in the underestimation of joint strength. This deficiency can be adequately overcome by applying the Q1SP formulation.

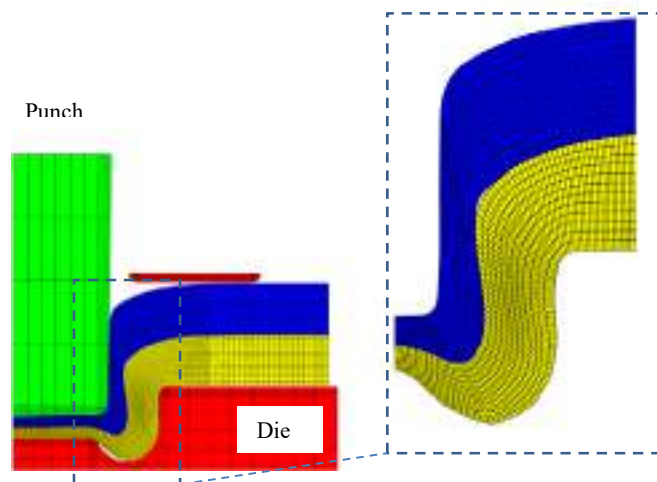


FIGURE 1. Deformation pattern in clinching process using Q1SP element

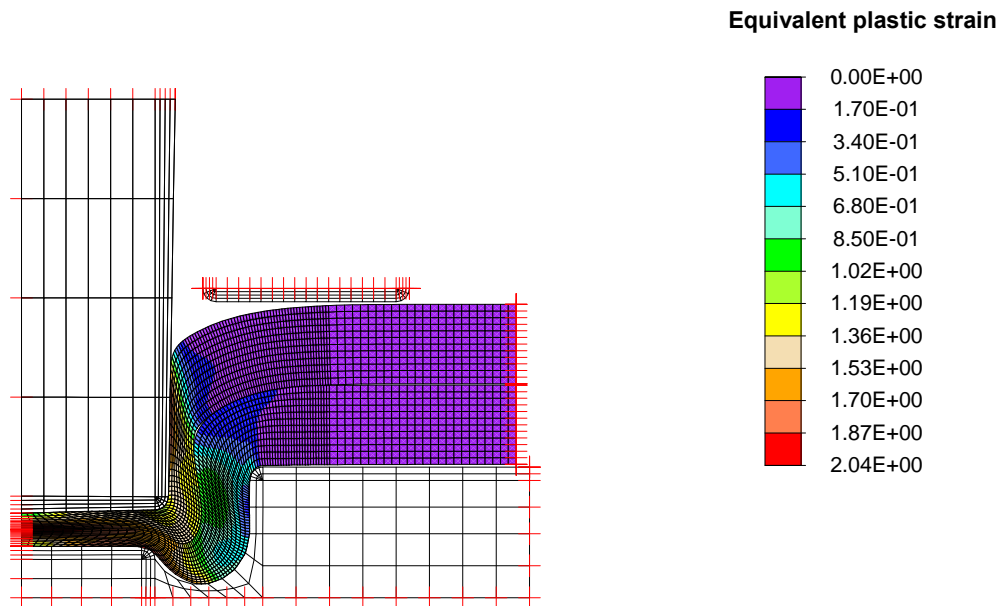


FIGURE 2. *Contour plot of equivalent plastic strain in clinching process*

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