

DESIGN FOR MANUFACTURABILITY OF AUTOMOTIVE PART CONSIDERING FORMABILITY AND SPRINGBACK

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ABSTRACT

Sheet metals are used for most of the BIW and structural parts. The advantage of HSS materials is that relatively lesser thick metals can be used compared to medium strength steels, because HSS material's Yield Strength (YS) and Tensile Strength (TS) are higher. The basic challenge with HSS sheet is high spring back after forming. Due to higher range of YS, the usual forming tonnage may not be able to bring all areas of part into plastic zones. When compared to medium strength steels the area which is below YS will be more in a Stress-Strain diagram. This results in great amount of spring back. In the present study, the mechanism of metal forming is studied to understand the effects of forming parameters (draw ratio, punch radius, Die radius, degree of bend, etc.) and material properties like (Yield Strength (YS), Tensile Strength (TS), Elongation, Co-efficient of work-hardening; n-value, Anisotropy ratio; r-value). Forming Limit Diagram is widely used to understand the formability of a material. A computer aided metal forming software which is based on Finite Element Method, called Auto Form is used for forming simulation. The results of forming (thinning, wrinkles, cracks etc) and spring back are analyzed against material properties. Based on the results, the course of design changes to part are planned and implemented through CAD (Computer Aided Design) package. The modified part will be re-simulated using Forming tool without changing parameters. This final forming simulation helps to analyze the effect of design changes made. The design changes based on forming simulation results can be repeated if spring-back is not reduced. These iterative changes made to original Part design helps in the reduction of manufacturing time and saves cost of proving the part in real-time manufacturing..

KEYWORDS: Sheet Metal, Hss Material, Spring Back & Formability