Numerical simulation of elastic springback in problems including large elastic-plastic strains

Walter B. Castelló*, Fernando G. Flores†

* Departamento de Estructuras, Universidad Nacional de Córdoba,
Casilla de Correo 916, 5000 Córdoba, Argentina,
wcastello@efn.uncor.edu

†Departamento de Estructuras, Universidad Nacional de Córdoba and CONICET,
Casilla de Correo 916, 5000 Córdoba, Argentina,
fflores@efn.uncor.edu

ABSTRACT

Deep drawing of sheets, is one of the most used manufacturing processes for metal forming. In these processes, the proper design of the tools geometry allows the fabrication of very complex parts with a high level of precision. The formed blank may exhibit defects such as wrinkles, thining and metal damage, also they may present important differences with the target geometry due to elastic recovery or springback. In this paper, the elastic-plastic two-surface model of Yoshida-Uemori [1-2] is used to study the influence of springback in deep drawing problems. The two-surface constitutive model allows taking into account the variation of the elastic modulus of the material as a results of the undergoing plastic strains. An elastic-plastic model with linear isotropic hardening including changes in the elastic modulus has also been considered in order to compare the results with the previous two-surface model. Experimental results show that the use of a plastic strain dependent elastic modulus may allow to adequately capture the geometry of the piece after springback. The results obtained in this study agree with those obtained experimentally in [1-2] and numerically in [3]. It has also been found that when the kinematic-hardening is no high the model with only isotropic hardening adequately captures the springback phenomenon.

REFERENCES

[1] Yoshida, F. y Uemori, T. “Elastic-plastic behavior of steel sheets under in-plane cyclic tension-compression at large strain”. *International Journal of Plasticity*, **18**, 633-659 (2002).

[2] Yoshida, F. y Uemori, T. “A model of large-strain cyclic plasticity describing the Bauschinger effect and workhardening stagnation”. *International Journal of Plasticity*, **18**, 661-686 (2002).

[3] Ghaei, A., Green, D.E. y Taherizadeh, A. “Semi-implicit numerical integration of Yoshida-Uemori two surface plasticity model”. *International Journal of Mechanics Sciences*, **52**, 531-540 (2010).