STUDIES REGARDING THE DEFINITION AND USE OF YIELD CRITERION IN THE SIMULATION OF THE DEEP DRAWING PROCESS OF SHEET STEEL

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In the analysis of the straining processes it is important for one to know the conditions in which the material passes from elastic to plastic form. In the case of multiaxial stress it is necessary to choose a criterion based on which we can determine the relation which has to exist between the main stresses so that the material should be stressed in the plastic field.

In this work we compare four plasticity criteria (Von Mises, Hill-1948, Hill-1990 and Ferron) which can be used in defining the material of the sheet steel during the simulation of the deep drawing process. The experimental work is made on A5 sheet steel.

The yield criterion formulated by Budiansky in 1984 was generalized for the transversal anisotropy of sheet in 1994 by Ferron:

$$(1-k)^{\frac{m}{6}} g^{-m}(\theta,\alpha) = F(\theta)^{\frac{m}{6}} - 2a\sin\theta\cos^{2n-1}\theta\cos 2\alpha + b\sin^{2p}\theta\cos^{2q}2\alpha \quad (1)$$

The function g(θ) is defined by Ferron with the relation:

$$(1-k)g(\theta)^{-6} = F(\theta) = (\cos^2\theta + A\sin^2\theta)^3 - k\cos^2\theta\cdot(\cos^2\theta - B\sin^2\theta)^2 \quad (2)$$

where: k, A, B are positive constants.

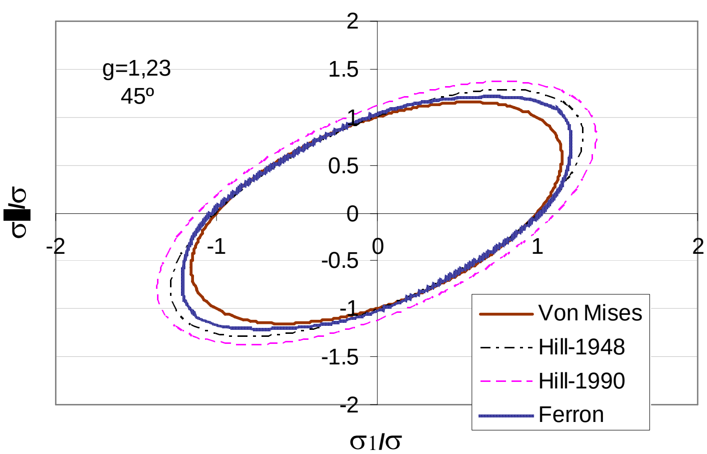

Fig. 1 Plane stress yield surfaces defined by von Mises, Hill's quadratic and Ferron's criteria

The values of the material's constants can be determined if we know the anisotropy coefficient R, σ_u/σ, τ/σ, where σ_u is the traction tension and τ the tension to pure shear. By modifying the values of the coefficients k, A, B, m, n, p, q, a, b, we can obtain the expressions of the various yield criteria already mentioned.

If we draw the plasticity surfaces for every criterion used by taking into account the coefficients calculated we obtain the figure 1, for h=1.23.

REFERENCES

[1] Ferron, G., Makkouk, R., Morreale, J., *A parametric description of orthotropic plasticity in metal sheets*, International Journal of Plasticity, Vol.10, No 5, 1994, Pag. 431-449

[2] Iordache M., Bourgeois N., Moreira L. P., Martiny M., Ferron G. (2008) *Experimental and Numerical Analysis of the Formability of Anisotropic Steel Sheet*, International Review of Mechanical Engineering - March 2008, ISSN 1970 – 8734