شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثـــائق الأصـليـة تـالفـــة

بالرسالة صفحات

لم ترد بالأصـــــل

PREDICTION OF FORMING LIMIT CURVES FOR KINEMATICALLY HARDENED VOIDED SHEET METALS

by

Eng. Nader Nabil Mohamed El-Laithy

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE
in
MECHANICAL DESIGN AND PRODUCTION

Under the Supervision of

Prof. Dr. Abdel-Rahman Ragab

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FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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ABSTRACT

Forming limit curves (FLC) play a major role in sheet metal forming processes. They identify the limit strains for biaxially stretched sheets. Several attempts have been made in order to predict FLC theoretically. Still a totally satisfactory agreement with the experimental results has not yet been totally achieved.

The objective of this work is to establish a kinematic-hardening model to predict forming limit curves for voided sheet metals. The model is based on combining three basic yield criteria of the theory of plasticity, namely: von-Mises criterion for a void-free matrix material, Gurson-Tvergaard criterion for voided solids and kinematic-hardening rule due to Prager-Ziegler. A unified complete description of plasticity constitutive laws are derived, e.g. yield function, flow rule and void growth laws.

A computer program is developed to use a mathematical model containing all the parameters involved in the process of biaxial stretching of sheet metals. The model has been then applied to investigate the influence of various material parameters such as, strain-hardening exponent "n", strain-rate sensitivity "m", average anisotropic coefficient "$\bar{r}$", the initial void volume fraction "C_{vo}" and the initial sheet imperfection "f_o" on the prediction of limit strains and the FLC.

Comparisons between theoretical predictions and experimental FLC show that reasonable agreements among the ones using present formulation and the experiments are realized. This was done by using the kinematic-hardening model coupled with realistic material data extracted from literature for various metallic alloys; steels, aluminums, brasses and coppers.

Finally an investigation for forming limit curves for non-linear or complex strain paths has been made. The predicted results show improved agreement with experiments.

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