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JUDUL: FINITE ELEMENT MODELLING OF OLSEN-ERICHSEN SHEET METAL FORMABILITY TEST

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FINITE ELEMENT MODELLING OF ERICHSEN OLSEN SHEET METAL FORMABILITY TEST

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LIST OF SYMBOLS

ε	Strain
$\Delta\sigma$	Stress range
σ_m	Yield stress of deformed material
σ_t	Tensile stress
N	Newton
ε	Strain
σ	Stress
F	Force
A	Area
E	Modulus of Elasticity
k	kilo

LIST OF ABBREVIATIONS

cm	centimetre
OET	Olsen-Erichsen Test
FEM	Finite Element Method
m^2	Metre square
OET	Olsen-Erichsen Test
FEA	Finite Element Analysis
DOF	Degree of Freedom

ABSTRACT

The main objective of this project is to assess the characteristic and formability of sheet metal to withstand plastic deformation without rupture using finite element method or to be more specific using ALGOR software with Olsen-Erichsen Test. Olsen-Erichsen Test is the one of the most popular technique since it is the method that used long before compare with other method. In this test there is a variable that being manipulate which are the element definition and type of material like aluminium, magnesium and brass. Meanwhile the variable that constant is the size dimension. After the drawing drawn in ALGOR software fill in the information needed to run the simulation and the data needed is collected. Through the data, the graph of displacement deformation between axis Z and Y is plotted. The data is analyse and found that magnesium is the most ductile followed by aluminium and brass. From the research data, it can be verify using the information in table of material properties to check the result from simulation is right or not.

ABSTRAK

Objectif utama dalam kajian ini adalah untuk menganggar sifat dan kebolehan bahan kepingan logam dalam menampung perubahan bentuk plastik sebelum bahan tersebut mengalami kerosakan dengan menggunakan kaedah finite element atau dengan lebih tepat lagi menggunakan aplikasi perisian ALGOR melalui Ujian Olsen-Erichsen. Ujian Olsen-Erichsen ini adalah antara kaedah yang sangat terkenal kerana merupakan salah satu kaedah yang paling awal digunakan berbanding kaedah yang lain. Di dalam ujian ini terdapat pemboleh ubah yang di manipulasikan iaitu definisi elemen dan juga jenis bahan yang berlainan iaitu aluminium, magnesium dan juga tembaga. Manakala pemboleh ubah yang di malarkan ialah dimensi saiz bentuk bahan. Setelah lukisan dibuat di dalam perisian Algor, isikan maklumat yang diperlukan untuk menjalankan simulasi dan data yang diperlukan disimpan. Melalui data tersebut graf perubahan bentuk antara paksi Z dan Y dihasilkan. Data dianalisis dan didapati magnesium paling mudah berubah bentuk diikuti oleh aluminium dan tembaga. Daripada data kajian, ia boleh disahkan menggunakan maklumat dalam jadual sifat bahan menentukan keputusan data kajian simulasi adalah benar atau tidak.

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

The Olsen-Erichsen test is a method of measuring the ductility and drawing properties of strip or sheet metal which involves determination of the width and depth of impression. It is the oldest formability method of measuring the ductility and drawing properties of sheet metal. The test simulating a deep drawing operation is made by a cupping test in which a piece of sheet metal, restrained except at the center, is deformed by a cone-shaped spherical-end plunger until fracture occurs. The height of the cup in millimeters at fracture is a measure of the ductility. This test is sometimes used to detect stretcher straining and indicates the surface finish after drawing,

1.2 PROBLEM STATEMENT

The products made by sheet-forming processes consist of a large variety of shapes and sizes, ranging from simple bends to double curvatures with shallow or deep recesses. In many cases while deforming the sheet metal, the component tends to fractures at certain point. The causes of failure are parameters related to forming process. One of the main

problems with the planning of sheet metal forming is the testing of formability in sheet metals and to forecast the results. So analysis in Olsen-Erichsen Test is done to analyze the criteria of sheet metal.

1.3 OBJECTIVE

The focus of this research is to assess the characteristic and formability of sheet metal due to elasticity and plasticity and also performing the simulation of Olsen-Erichsen Test. Using finite element method this study will estimate the ductility of the sheet metal.

1.4 PROJECT SCOPES

This research is focus on the effect of deformation displacement for different material after given nodal prescribed displacement. The scopes of this project are:

1.4.1 To perform a simulation for forming process of OET:

This simulation test covers the procedure for conducting the ball punch deformation test for Brass, Aluminum and Magnesium sheet metal intended for forming application.

1.4.2 To assess characteristic & formability of sheet metal:

Estimate the ductility of sheet metal of Brass, Aluminum and Magnesium sheet metal sheet metal from OET using the material properties table.

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