STATIC AND DYNAMIC ANALYSIS IN A DRAW PUNCH DESIGN

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ABSTRACT

The objectives of this study are :

1. To design a draw punch for the purpose of deep drawing a cylindrical cup.
2. To improve the draw punch design by determining the static and dynamic reliability of the draw punch.
3. To determine the life span of the draw punch under dynamic loading.

A static load is a force which has an unchanging magnitude, unchanging points of applications and unchanging direction. In this study, static analysis was performed using the Finite Element Method. Three different static failure theories namely *Maximum Normal Stress Theory*, *Maximum Shear Stress Theory* and *Distortion Energy Theory* were used to determine the static reliability based on the responses from Finite Element Method tools.

A dynamic load is any load which has a changing magnitude, direction and positions of applications. As such, the responses to dynamic loading such as stresses are also dynamic and varying with time. Dynamic analysis was performed using the Finite Element Method tools. The most significant characteristic of this dynamic analysis is that these dynamic stresses can cause fatigue failures although the actual maximum stress is below the yield strength. Failures have been caused by stresses that have been repeated for a large number of times.

List of Symbols :

μ coefficient of friction

F punch force

t blank thickness

D blank diameter

d cup diameter

h cup height

r strain ratio

S_{ut} nominal ultimate tensile strength

u_m value of unknowns at nodal points

N_m interpolation functions

σ_y stress in y direction

e_y strain in y direction

v_y deformation in y direction

k element property matrix

q vector of unknowns at element nodes

Q vector of element nodal forcing function

K assemblage property matrix

r assemblage vector of nodal unknowns

R assemblage vector of nodal forcing functions

E Young's Modulus Of Elasticity

S stress

A area

e deformation

$\in$ strain

L length

σ principal stress

τ_{max} maximum shear stress

List of Symbols

S_{yt} tensile yield strength

S_{yc} compressive yield strength

P load

f_I inertia force

f_S elastic force

f_D damping force

v displacement

p(t) applied load

k spring stiffness constant

c damping constant

W weight

S_e endurance limit / fatigue limit

S'_e axial endurance limit

S'_f fatigue strength of steel

S_{uc} ultimate compressive strength

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