

Correlations Between Axial and Oblique Loaded Column

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Abstract. In this study, the force response curve of the obliquely loaded empty aluminum column is analyzed and compared to its axially loaded column. Theoretical formula to calculate the axial mean force has been applied to obliquely loaded column, and it has yields a largely deviated value. Thus, a modified equation to cater for obliquely loaded column has been proposed.

1 Introduction

Due to the rapid development in the computational capabilities, simulation is well accepted by the as a way to reduce cost associated with physical test of preliminary design. Numerous research works has been presented on structure subjected to axial and bending, whereas a very limited study has been conducted on theoretical equation for oblique loading. This study will propose improvised axially loaded equation to predict the mean force of the obliquely loaded column based on simulation.

2 Theoretical backgrounds

The mean load, P_{mean} is a parameter commonly used to calculate the energy absorbing capability of a structure. Generally, it is defined as (White and Jones, 1999):

$$P_{mean} = \frac{E_a}{\delta} \quad (1)$$

where E_a is the total energy absorbed during collapse and δ represents displacement. According to Wierzbicki and Abramowicz (Abramowicz and Jones, 1986), the mean crushing force of axially loaded square tube can be calculated by

$$P_{mean,A} = 13.06\sigma_0 \cdot w_m^{1/3} t^{5/3} \quad (2)$$

where σ_u is the characteristics stress taken as

$$\sigma_0 = \frac{\sigma_{0.2} + \sigma_u}{2} \quad (3)$$

$\sigma_{0.2}$ is the stress at 0.2% plastic strain, σ_u is the ultimate stress and w_m is the mean width defined as

$$w_m = w - t \quad (4)$$

t is the column thickness and w is the outer column width.

3 Methodology

3.1 Validation

Figure 1 shows the deformation pattern for both experimental and simulation. The simulated crushed empty column is deformed in the same manner as in the experiment.

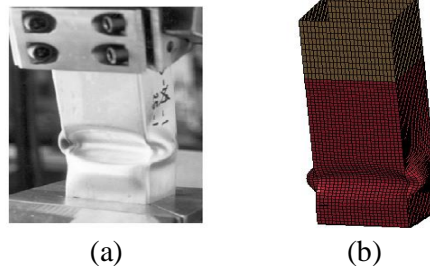


Figure 1. Deformation of empty column subjected to 5 degrees loading angle (a) experimental (Reyes et. al. 2002) and (b) simulation

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