EQUIVALENT AXIAL LOAD THAT INCORPORATES THE BENDING EFFECT

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January 5, 2010

Column

Consider a column subjected to an axial load and a bending moment.

The equivalent axial load P' is

$$P' = P + B_x M_x + B_y M_y \tag{1}$$

where

P'	=	Equivalent axial compression load for design
P	=	Actual compression load
B_x	=	Bending factor for the column x-axis
M_x	=	Bending moment about the column x-axis
B_y	=	Bending factor for the column y-axis
M_y	=	Bending moment about the column y-axis

Large Diameter, Thin-Walled Cylindrical Shell

The equations in this section are taken from Reference 1.

The equivalent axial load is calculated by converting the stress from the moment into an axial stress and then into an axial load.

The equivalent axial load P_e is

$$P_e = fA = \frac{Mc}{I} A \tag{2}$$

$$P_e = \frac{M\, r\, (2\pi\, r\, t)}{\pi\, r^3 t} \tag{3}$$

$$P_e = 2\frac{M}{r} \tag{4}$$

where

A = Cross-sectional area of the thin-walled cylindrical shell

f = Maximum stress in the wall from the moment

M = Moment on the cylindrical shell

r = Radius

Reference

1. C. Brown, Elements of Spacecraft Design, AIAA Education Series, 2003.