

PROKON Support Portal

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Relationship between Second Order & Buckling Analysis

Andrew - 2019-08-30 - 0 Comments - in Analysis

When attempting to do a Second-Order analysis and the analysis is unsuccessful, a common error message states that you must check for instability. A good method of determining the location of the instability is to do a Buckling analysis.

You can use a buckling analysis to calculate the safety factors for structural instability due to buckling. This can be demonstrated by loading a simply supported column with the Euler Critical Load. In the following example, a 220x220 concrete section was used as the column section. The height of the column is 3m.

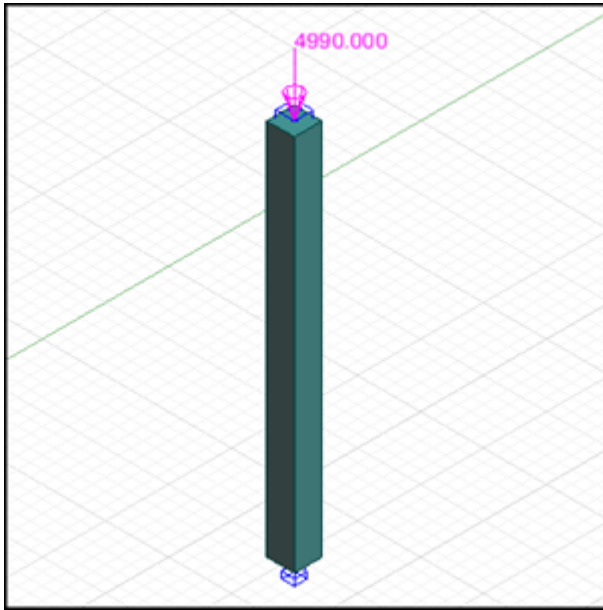


Image 1: Simply supported column loaded with Euler Critical Load.

$$E = 25 \times 10^6 \text{ kPa}$$

$$I = 182 \times 10^{-6} \text{ m}^4$$

$$k = 1.0$$

$$L = 3 \text{ m}$$

Euler Critical Load:

$$P_{cr} = \frac{\pi^2 \cdot E \cdot I}{(k \cdot L)^2} = 4\,989.633 \text{ kN}$$

Figure 2: Euler Critical Load for example column.

The column is loaded with a single point load equal to the Euler Critical Load and a buckling analysis is done. The buckling factor is calculated as 1.000:

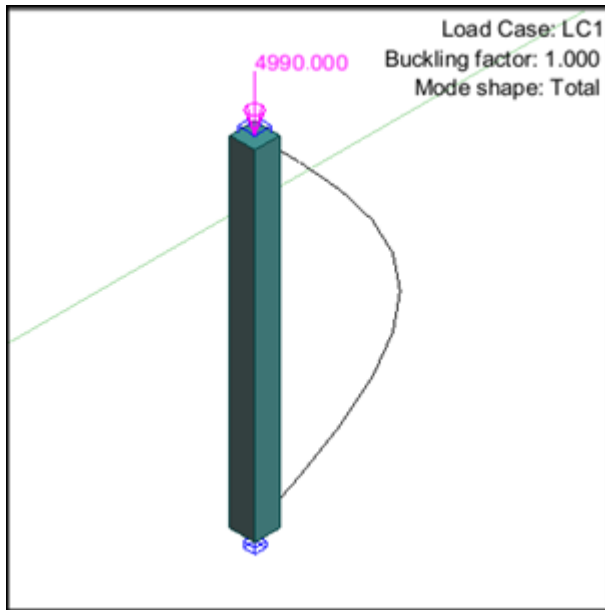


Figure 3: Buckling Analysis result.

Any load larger than the Euler Critical Load will cause the column to be unstable. A buckling factor larger than 1 indicates that the structure is stable whereas if the buckling factor is less than 1, the column is unstable (a negative value indicates that the column is in tension and will not buckle).

If the overall buckling factor of a structure is between 0 and 1, it is an indication that the structure is unstable. Since a second-order analysis takes the effect of sway into account, the analysis won't be successful if the structure is unstable (buckling factor between 0 and 1).