Product requirement document (PRD)

Software title

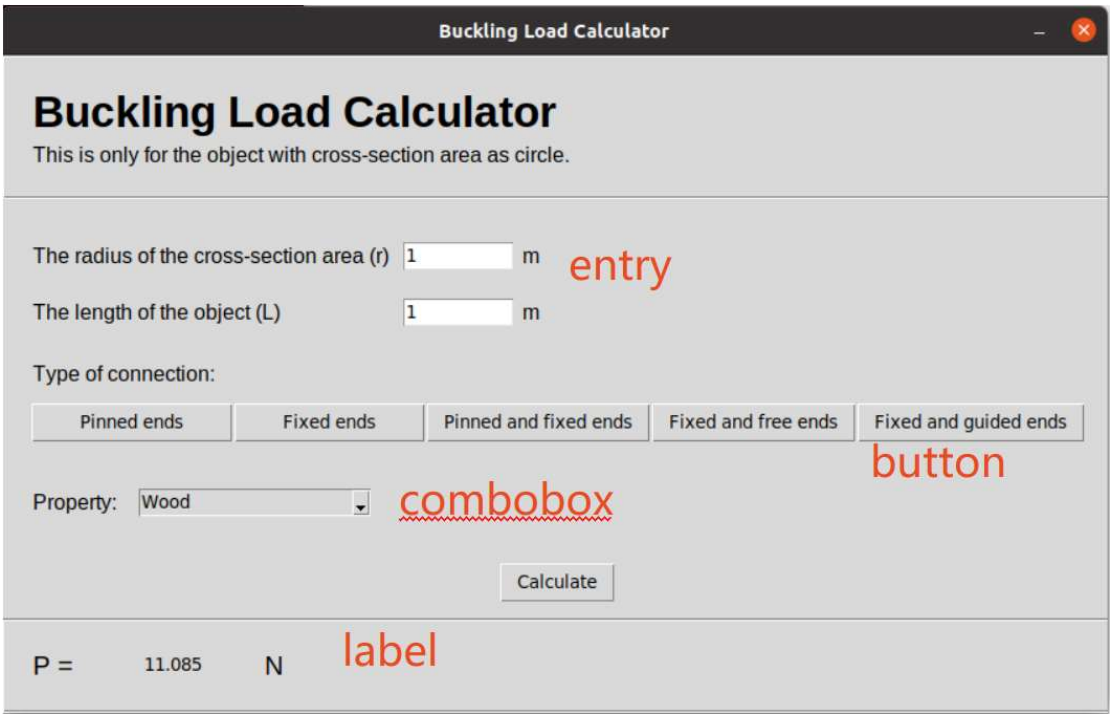
buckling load calculator

Background

the overall context of this software contains GUI part and logic part.

In the GUI part, the user interface is designed through four types of widgets: entry, button, label and combobox. The radius and vertical height of the object are entered through entry, the connection method is selected through button, the material properties are selected through combobox and the calculation results are displayed through label.

In the logical part the input values are obtained by means of commands such as get, lambda etc. and the buckling load is calculated according to the formula principle, which will be described in this paper.



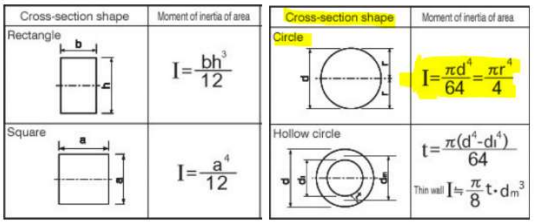
Motivation

In the lecture axial compression, we learnt about buckling load, buckling failure occurs because materials find ways to move 'out from under' the compression load. We also learnt that five types of connection determine the effective length when calculating the buckling load, so we wanted to design a buckling load calculator which could be used to calculate the buckling load of an object with a circular cross-section. We offered the two main construction material options of wood and brick and provided five alternative types of connection.

Fundamentals

Second Moment of Area (I)

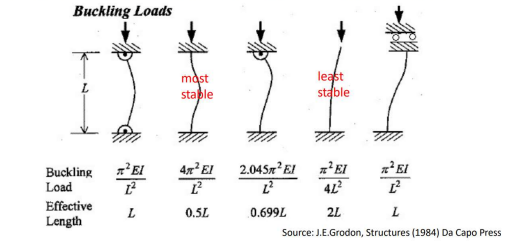
The ***Second Moment of Area*** or ***Area Moment of Inertial***(**I**) is a geometrical property of an area which reflects how its points are distributed with regard to an axis.



Euler's Critical (Buckling) Load

Effective Length (K)

Effective length is the distance between the flectural points (zero moments) in a member. ***Effective length* is determined by the end-condition of members**: anything that prevents members hinging at ends will reduce the ***effective length*** and thereby increase the ***buckling load***.



Source: J.E.Grodon, Structures (1984) Da Capo Press

The diagram on the left shows the formula for The Second Moment of Area for an object with a cross section shape of circle, the diagram on the right shows the five types of connections for the object

Key functions of the software

The software can calculate buckling load (P) on an object with a circular cross-section, made of brick or wood.

Scientific methods

The Second Moment of Area for an object with a cross section shape of circle is:

$$I = \pi \frac{r^4}{4} \qquad \textit{Equ 1.}$$

where r is the radius and pi is the circumference of the circle

The Buckling load is calculated as:

$$p = \pi^2 \frac{EI}{L^2} \qquad \textit{Equ 2.}$$

Where I is Second Moment of Area, L is effective length, E is the Young's modulus of the object.

Similar products in the market

https://calcresource.com/statics-buckling-load.html