Project 2

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https://github.uio.no/FYS3150-G2-2023/Project-2

PROBLEM 1

We are studying the one-dimentional buckling beam, which can be described by the equation

$$\gamma\frac{d^2u(x)}{dx^2} = -Fu(x) \qquad \rightarrow \qquad \frac{d^2u(x)}{dx^2} = -\frac{F}{\gamma}u(x)$$

where γ is a constant determined by the material of the beam. We want to scale the equation, that is we want to scale by the x-value of the beams endpoint $x = L$. Scaling will result in a dimensionless variable $\hat{x} = \frac{1}{L}$.

$$\frac{d^2}{dx^2} = \frac{d}{dx}\frac{d}{dx} = \left(\frac{d\hat{x}}{dx}\frac{d}{d\hat{x}}\right)\left(\frac{d\hat{x}}{dx}\frac{d}{d\hat{x}}\right) = \left(\frac{1}{L}\frac{d}{d\hat{x}}\right)\left(\frac{1}{L}\frac{d}{d\hat{x}}\right) = \frac{1}{L^2}\frac{d}{d\hat{x}^2}$$

where we have used $\frac{d\hat{x}}{dx}\frac{d}{d\hat{x}} = \frac{d}{dx}\frac{d\hat{x}}{d\hat{x}}$

where $\hat{x} \equiv \frac{x}{L}$ and $\frac{d\hat{x}}{dx} = \frac{1}{L}$

Now we insert the expression into the original equation

$$\frac{du(\hat{x})}{d\hat{x}^2} = -\frac{FL^2}{\gamma}u(\hat{x})$$

PROBLEM 2

The functions that set up the tridiagonal matrices can be found in **matrix.hpp** and **matrix.cpp** in the Github repo.

The test for this can be found in **test_suite.cpp**.

PROBLEM 3

a)

The function for found the largest off-diagonal can be found in **matrix.hpp** and **matrix.cpp**.

b)

The test for (a) can be found in **test_suite.cpp**.

PROBLEM 4

a)

The code for Jacobi's rotation algorithm can be found in **jacobi.hpp** and **jacobi.cpp**.

b)

The test for (a) can be found in **test_suite.cpp**.

PROBLEM 5

PROBLEM 6