

## Discretization methods for Engineering Assignment 2: Rayleigh method

Due date: 1 - october

**Problem 1.** Consider the problem of the extension of a string seen in the lecture. Find, using the Rayleigh-Ritz method, the best displacement of the form

$$u(x) = \sum_{a=1}^N d_a \cdot \sin(a x) \quad (1)$$

with  $EA = 2$ ,  $L = 1$ ,  $f(x) = e^{x/L} - \frac{e}{2}$ . Consider and compare three cases:  $N = 3, 4$  and  $5$ , plotting the solution in each case.

For that:

- i) We consider first the system of equations of the form  $\mathbf{Kd} = \mathbf{F}$ . Write the analytic expression of  $F_a$ . Write a Matlab function of the form

```
function ret = sinforce(n,a)
```

that computes the value of  $F_a$  for any value of  $N$ .

- ii) Write the analytic expression of  $K_{ab}$ . Write a Matlab function of the form

```
function ret = sinStiffness(n,a,b)
```

that computes  $K_{ab}$  for any value of  $N$ .

- iii) Write a Matlab function

```
function sinPlot(d)
```

that plots a function of the form (1) for any vector of coefficients  $d_i$  as appearing in expression (1).

- iii) Write a Matlab program uses the other functions to compute and plot the approximate solution to the string problem for the three cases of  $N$  under consideration.