FEM for 1D problems

Linear spaces

Vectors calculus

$\underline{x}, \underline{y} \in \mathbb{R}^n$, $\alpha \in \mathbb{R}$

Addition

$\underline{z} = \underline{x} + \underline{y}$, $\underline{z} \in \mathbb{R}^n$

Multiplication with a number

$\underline{z} = \alpha \cdot \underline{x}$, $\underline{z} \in \mathbb{R}^n$

Function spaces

$f, g : \mathbb{R}^n \to \mathbb{R}$, $\alpha \in \mathbb{R}$

Addition

$h = f + g$, $h(x) = f(x) + g(x)$

Multiplication with a number

$h = \alpha \cdot f$, $h(x) = \alpha \cdot f(x)$

Definition (linear space): A set of objects which we can add and multiply with a number is called a linear space (if the usual rules apply)

Central idea: Work with functions in a similar way as with vectors in $\mathbb{R}^n$

We use

X for any kind of linear space and V for a space of functions