

# Advanced Partial Differential Equations

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# 1 Sobolev Spaces in $\mathbb{R}, \mathbb{R}^n$

## 1.1 Sobolev space

$\mathcal{C}^k$  spaces are Banach, but not Hilbert spaces. So how can one apply Lax-Milgram?

$$\begin{cases} -u'' + u = f & f \in \mathcal{C}^0([a, b]) \\ u(a) = u(b) = 0 \end{cases} \quad (1.1)$$