UNIVERSITY OF TWENTE.

Mixed finite elements for port-Hamiltonian models of von Kármán beams

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Overview

1. On the von-Karman assumption

Outline

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The von-Karman

This theory has puzzled mathematicians and physicists as the derivation of the model rely on some not well justified assumptions.

Membrane-bending problem for thin beams

For small deformations the membrane and bending behavior are uncoupled:

$$\frac{\partial}{\partial t}\begin{pmatrix}\alpha_u\\ \alpha_\varepsilon\\ \alpha_w\\ \alpha_\kappa\end{pmatrix} = \begin{bmatrix}0 & \partial_x & 0 & 0\\ \partial_x & 0 & 0 & 0\\ 0 & 0 & 0 & -\partial_{xx}\\ 0 & 0 & \partial_{xx} & 0\end{bmatrix}\begin{pmatrix}e_u\\ e_\varepsilon\\ e_w\\ e_\kappa\end{pmatrix}$$

If the material is isotropic

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