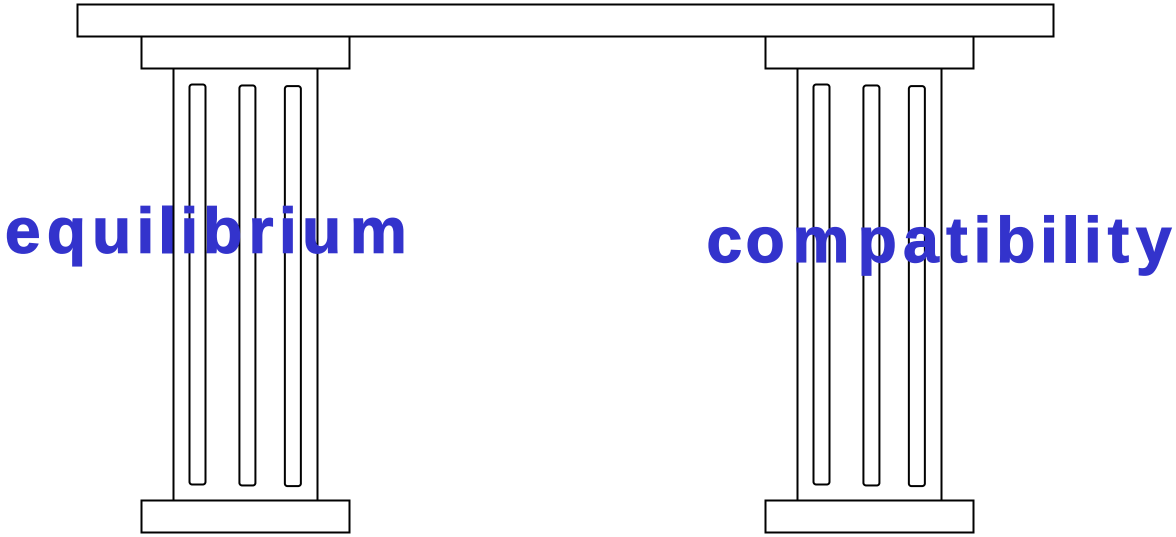
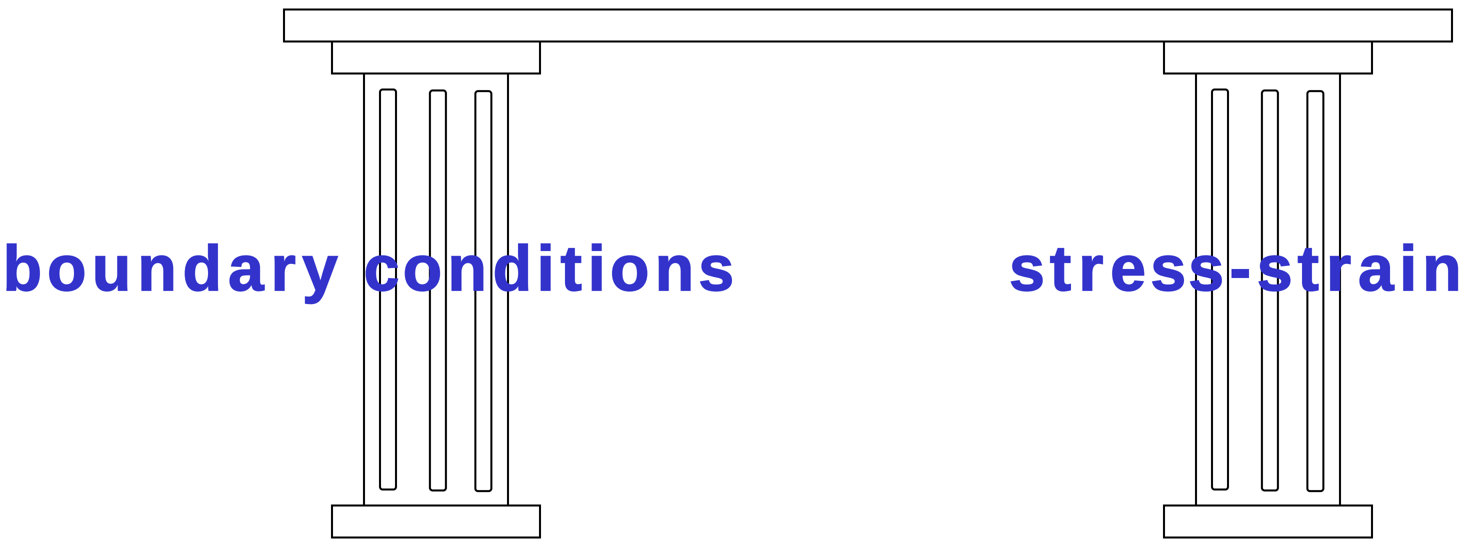
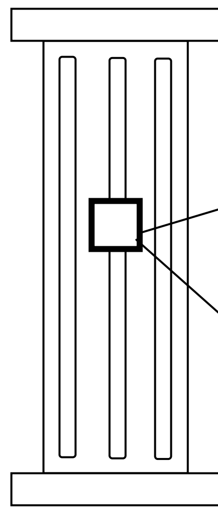
The four pillars



of all stress analyses



equilibrium



$$\sum \mathbf{F} = 0 \quad \Rightarrow \quad \sum_{j=1}^{3} \frac{\partial \sigma_{ji}}{\partial x_j} = 0$$

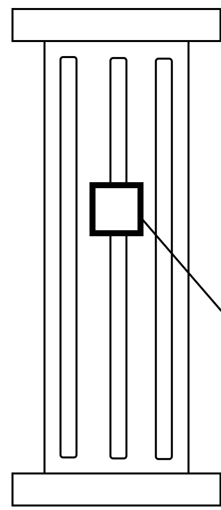
$$\sum \mathbf{M} = 0 \quad \Rightarrow \quad \sigma_{ij} = \sigma_{ji}$$

locally everywhere

compatibility

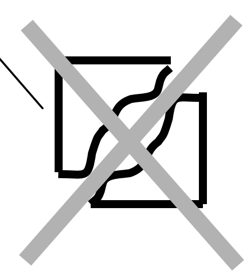
3-D: $R_{ijkl} = 0$

2-D: $2\dfrac{\partial^2 \varepsilon_{12}}{\partial x_1 \partial x_2} - \dfrac{\partial^2 \varepsilon_{11}}{\partial x_2^2} - \dfrac{\partial^2 \varepsilon_{22}}{\partial x_1^2} = 0$



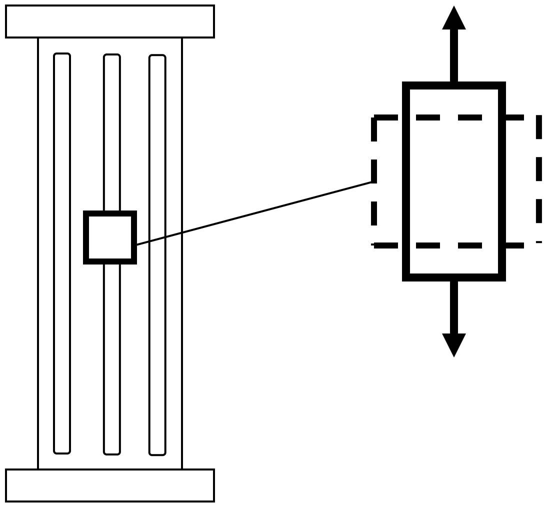
Given **u**(**x**) we can always find compatible strains through differentiation:

$$\varepsilon_{ij} = \frac{1}{2}\left(\frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i}\right)$$



compatible strains ➡ single valued displacements locally everywhere

stress-strain



For a linear elastic material

$$[\sigma] = [C][\varepsilon]$$

boundary conditions