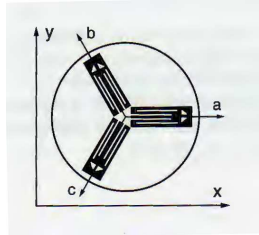


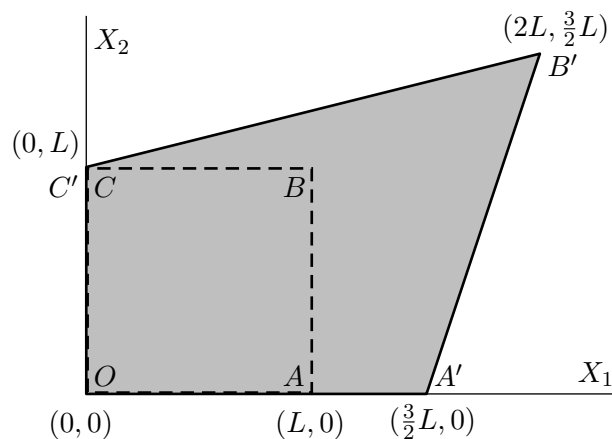
Introduction to materials modelling

4. exercise – deformation, strain

1. With a 120° -strain gauge rosette the following strains are measured: $\varepsilon_a = 400 \mu$, $\varepsilon_b = 630 \mu$, $\varepsilon_c = -280 \mu$. Calculate also the principal strains, the maximum shear strain and their directions.



2. Consider the deformation state shown in the figure below.



- (a) Determine the deformation mapping $\chi(\mathbf{X})$ and the deformation gradient $\mathbf{F}(\mathbf{X})$.
- (b) Determine the displacement field $\mathbf{u}(\mathbf{X})$.
- (c) Determine the Green-Lagrange strain tensor \mathbf{E} , infinitesimal strain tensor $\boldsymbol{\varepsilon}$ and the infinitesimal rotation tensor $\boldsymbol{\Omega}$.
- (d) Calculate the deformed length of $|C'B'|$, initially CB by using the Green-Lagrange strain tensor and the infinitesimal strain tensor.
- (e) Calculate the deformed length of $|OA'|$, initially OA by using the Green-Lagrange strain tensor and the infinitesimal strain tensor.
- (f) Determine the relative volumetric change both by using the deformation gradient and by using the linear strain tensor.
- (g) What are your conclusions from cases (d)-(f)?