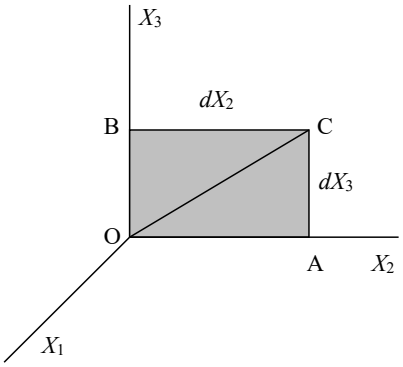
Exercise 1: A solid is subjected to the following deformation:

$$x_1 = X_1, \qquad x_2 = X_2 + aX_3, \qquad x_3 = aX_2 + X_3$$

Determine the right Cauchy-Green deformation tensor ***C*** and the Green-Lagrange strain tensor ***E***.

Exercise 2: Consider the small rectangle in the following figure:



For the deformation given in Exercise 1,

1. Calculate the square of OA, OB and OC after deformation,
2. Calculate the variation of the squares of the segments OA, OB and OC,
3. Calculate the angle formed between segments OA and OB after deformation.

Exercise 3: The deformation of a continuum is given by,

$$x_1 = X_1 + \gamma X_2, \qquad x_2 = X_2 + \gamma X_3, \qquad x_3 = X_3 + \gamma X_1$$

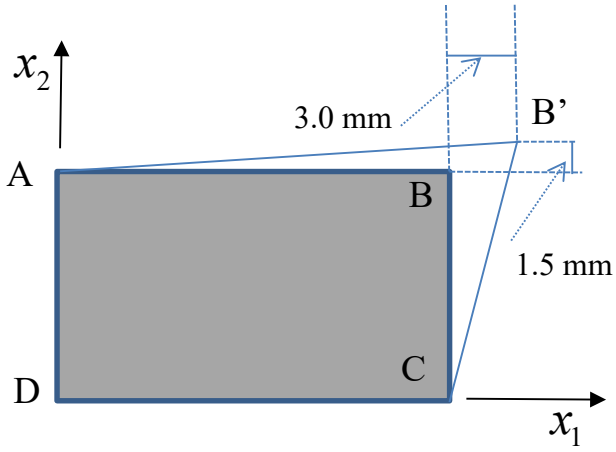
1. Calculate the Green-Lagrange ***E***, and the Euler-Almansi ***e***, deformation tensors.
2. Compare the two in the case where γ is very small.

Exercise 4: A displacement field dis given by,

$$u_1 = 3x_1x_2^2, \qquad u_2 = 2x_3x_1, \qquad u_3 = x_3^2 - x_1x_2$$

1. Determine the components of the infinitesimal strain tensor.
2. Verify the compatibility equations (B2.175).

Exercise 5: A 3m by 2m thin plate is deformed by the movement of the corner point B to B' (see figure below). If the displacement field is given by $u_1 = c_1 x_1 x_2$, $u_2 = c_2 x_1 x_2$ where c_1, c_2 are constants, determine,

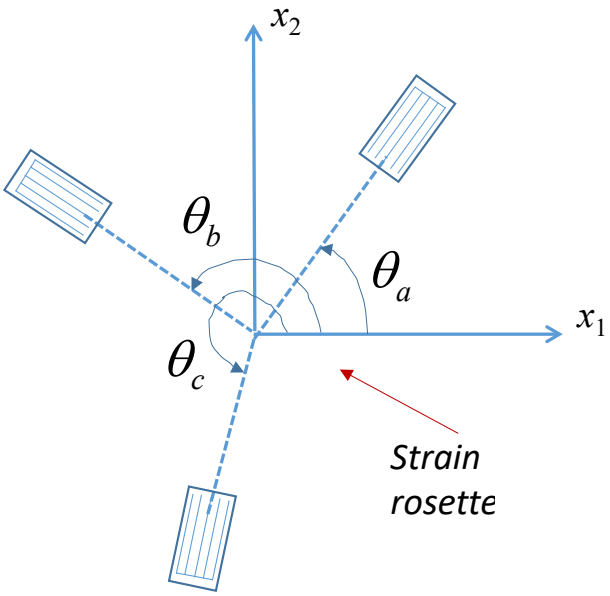


Dimensions: AB = CD = 3m;

AD = BC =2 m

1. The expressions for the displacements (identify c_1, c_2)
2. The strain components,
3. The normal strain along the direction BD.

Exercise 6: A 60º strain rosette reading system, shown in the figure below, is attached on the free surface of a plate before loading. For this particular rosette,



$\theta_a = 0^o$; $\theta_b = 60^o$; $\theta_c = 120^o$ After loading, the strain readings

$\varepsilon_a = 190\mu\varepsilon$, $\varepsilon_b = 200\mu\varepsilon$, $\varepsilon_c = -300\mu\varepsilon$

Determine (a) the in plane principal strains and their directions, (b) the maximum shear strain.