Université Mohamed - KHIDER - BISKRA
Département de Génie Mécanique – MMC / Master – 2026/2027
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Travaux Dirigés (**Série n°3-bis**)

Exercise N° 01 :

We consider the following displacement field U= $P_0 P_1$ =(u_1, u_2, u_3) :

$$u_1 = 9\,k\,x_1 + 8\,k\,x_2$$
$$u_2 = 16\,k\,x_1 - 9\,k\,x_2$$
$$u_3 = 5\,k\,x_3$$

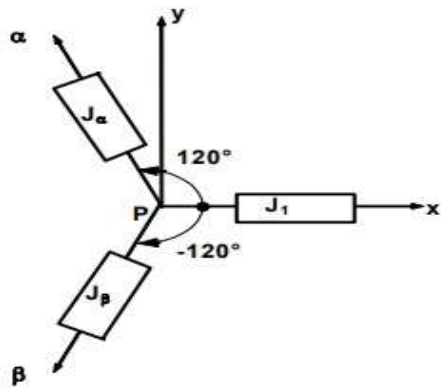
where k is sufficiently small to ensure the validity of the small-deformation assumption (k>0)

1°) Determine the linearized strain tensor.
2°) Determine the principal elongations and the principal directions.
3°) °) Consider a steel sphere with a diameter of one meter (1m) subjected to the previously defined strain field (take $k=10^{-3}$).

a) What does this sphere become after deformation??
b) Determine its characteristic lengths (in mm).
c) Determine its initial and final volume

Exercise N° 02 :

Consider a point P on the surface of a body, located where no external forces are acting. Within the plane tangent to the surface, the unit linear strains are measured along three chosen axes x, β and α as shown in the adjacent figure. The measurement results are as follows:



Gauge J_1= 200.10^{-6}

Gauge J_α= 80.10^{-6}

Gauge J_β= -40.10^{-6}

1°) Determine the strain tensor at point P.

2°) Determine the principal elongations and the principal directions.