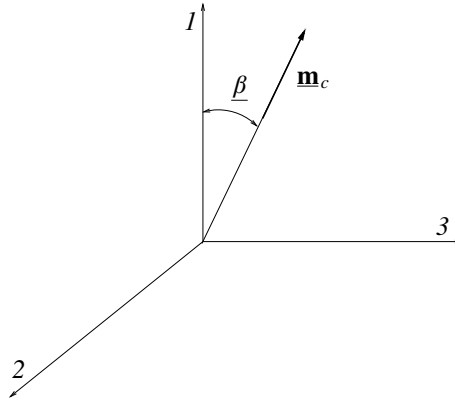




Interdepartmental Program of Postgraduate Studies in "Applied Mechanics"
Erasmus Mundus Joint Master Program "STRAINS" in "Advanced Solid Mechanics"
Examination in "Biomechanics of Soft Tissues"
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Question 1 (3,3)

A single family of fibers possesses rotational symmetry with respect to the axis of extension 1. Each fiber forms an angle β with the axis of extension 1, in the undeformed configuration. Axes 2 and 3 are axes of contraction, due to the extension along the axis 1. Each fiber can be activated only under extension along its longitudinal direction, indicated by the unit directional vector $\underline{\mathbf{m}}_c(m_1, m_2, m_3)$, in the undeformed configuration. A strain field with an extensional Lagrangian strain component E_{11} and two contractional Lagrangian strain components $E_{22} = E_{33}$, is applied to the fibers. Determine the range of the angles β for which the fibers are activated (are under extension).



Question 2 (3,3)

Regarding cornea:

1. Write two expressions for the incremental work δW done on the tissue.
2. Write two expressions for the electrochemical potential g_{kK}^{ec} regarding:
 - Incompressible components.
 - Compressible components.

Question 3 (3,4)

Two families of parallel fibers, with unit directional vectors in the undeformed configuration $\underline{\mathbf{m}}_1$ and $\underline{\mathbf{m}}_2$ respectively, exist in two adjacent lamellae of the stroma layer of the cornea. The angle between the two families of the fibers and the bisector of the second and fourth quadrants of the system of axes $(\underline{\mathbf{e}}_1, \underline{\mathbf{e}}_2)$, is ϕ .

1. Calculate the angle $(\underline{\mathbf{m}}_1, \underline{\mathbf{m}}_2)$ between the two families of fibers.
2. Write an expression, relating the angle ϕ with the unit directional vectors $\underline{\mathbf{m}}_1$ and $\underline{\mathbf{m}}_2$.
3. Write an expression, relating the structural second order tensor $\underline{\underline{M}}_S$ with the unit directional vectors $\underline{\mathbf{m}}_1$ and $\underline{\mathbf{m}}_2$ (prove the validity of this expression).