MSE 214 (Composites A)
Exercices-Constituants-Anisotropie
8 Octobre 2025

Question 1. Citez au moins 4 exemples de matériaux anisotropes.

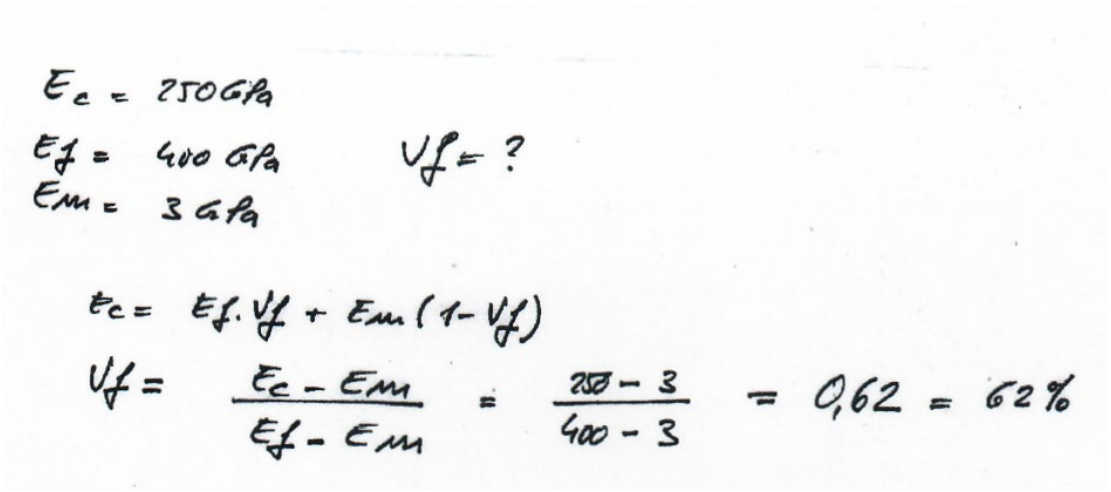
le bois, le béton armé, les muscles, les composites à fibres orientées….

Question 2. Classez les fibres suivantes dans un ordre croissant de leur déformation à la rupture : coton, verre , Kevlar 49, carbone HS, carbone HM, lin

Carbone HM : 0.5-0.8% slide 34 Propriétés
Carbone HS: 1.4-1.8% slide 34 Propriétés
Verre : 2.5-4.5% slide 55
Kevlar 49: 2.8% slide 46
Lin: 2.7-3.2% slide 55
Coton: 7-8% slide 55

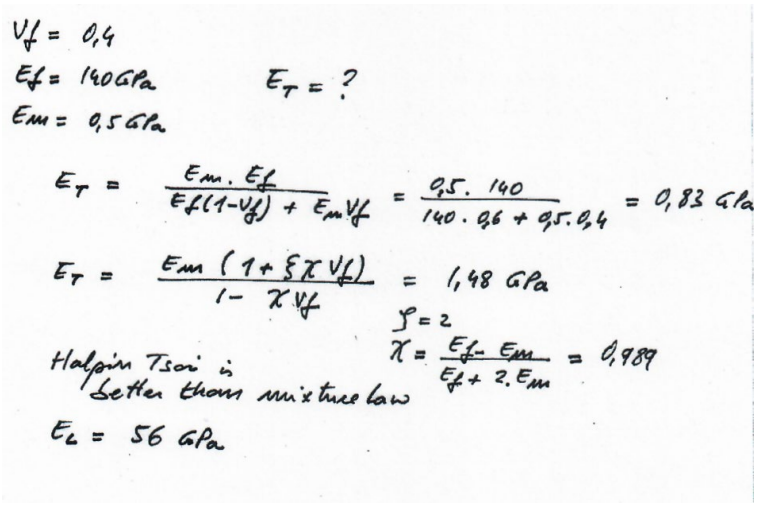
Question 3.

Le module d'un composite unidirectionnel à fibres continues est mesuré à 250 GPa. Les fibres sont en carbone avec un module de 400 GPa et la résine epoxy qui les entoure a un module de 3 GPa. Quelle est la quantité de fibres dans ce composite ?



Question 4.

Propose 2 methods for determining the transverse modulus of a composite with 40% volume of continuous fibres (Modulus= 140 GPa) in an elastomeric polymer of 500 MPa modulus.
Determine the 2 modulii with the 2 methods.
Compare the 2 obtained values and explain the difference.
Compare these transverse modulii with the longitudinal modulus of the same composite.



Method 1: Mixing law for transverse modulus
Method 2: Halpin Tsai
Halpin Tsai provides a better estimation for transverse and shear modulii than the mixing law which has hypotheses on lateral displacements of matrix and fibres, elastic behaviour of materials….

Question 5.

Glass fibres (E=70GPa) reinforce PP (E= 1 GPa) in a bumper (Vf =0.3). The have an initial length of 3 mm and a diameter of 20 um. After injection in the mould the fibre length is 400 um. What is the reduction of modulus induced by the processing?