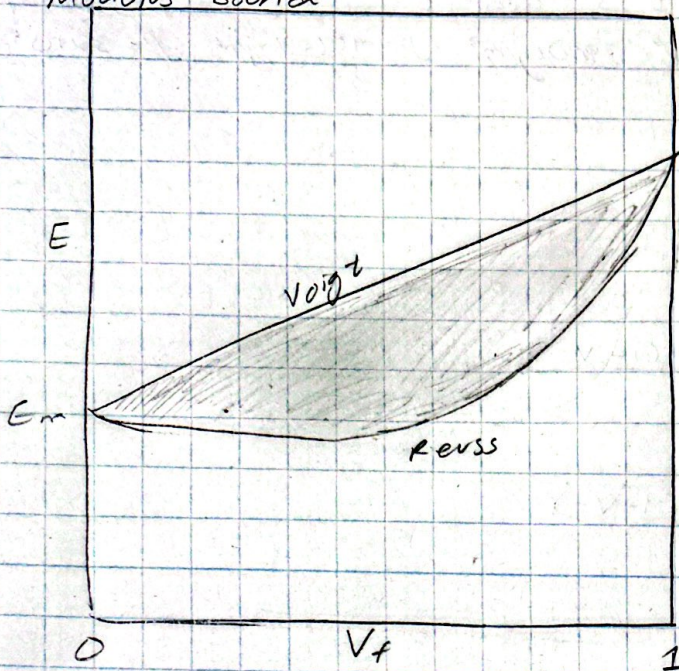


Question 1

Voigt and Reuss
Modulus Bound

Reuss Bound

$$\frac{1}{E} = \frac{V_f}{E_f} + \frac{(1 - V_f)}{E_m}$$

assumes stress is constant
through all layers

Voigt Bound

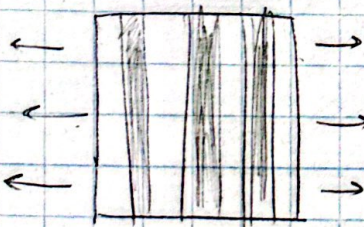
$$E = V_f E_f + (1 - V_f) E_m$$

assumes the strain is constant
through all the layers

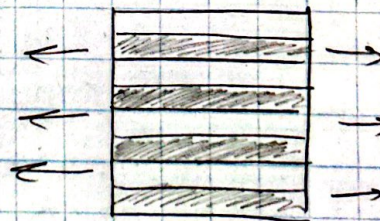
Derivations are based on the composite's density equation

$$\rho = V_f \rho_f + (1 - V_f) \rho_m$$

Reuss Bound

Through constant stress
in all layers while
subjected to an arbitrary
average strain field.

Voigt Bound

Through constant strain
in all layers while
subjected to an arbitrary
average stress field.