Class 22 Highlights
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ESS 411 Continuum Mechanics

In class 22, we wrapped up our discussion of strain and began our discussion on moments. We established the setup for our discussion of moments, which is a mass at the end of a low-mass wire attached to a pivot point. In this arrangement, the moment is the cross product of a force (in this case, gravity acting on the mass) and the lever arm. We then discussed the stress and force balances in a hanging plate. The total stress σ_{11} in a small section of the plate must be zero, but in the upper part there is tension, so σ_{11} is greater than zero, and in the lower part there is compression, so σ_{11} is less than zero. The moment due to gravity on the beam to the right (away from the pivot point) of a certain point x_1 is $M_g = -\frac{1}{2}\rho g t(L - x_1)^2$, negative because gravity gives a left-handed torque. This moment must be balanced since the arm is not accelerating, thus there is a moment due to stress of equal and opposite magnitude ($M_t = \frac{1}{2}\rho g t(L - x_1)^2$). Shear stresses do not contribute because they do not have a moment arm. Finally, we briefly touched on the idea of double couple faulting – slip on a fault is due to force double couples because otherwise angular momentum would not be conserved.