Physics 331

Problem I

An elastic medium has a stress tensor as a function of position given by

$$\Sigma = \begin{pmatrix} -2+x & z^2 & yz \\ z^2 & -2+y & y^2 \\ yz & y^2 & -2+z \end{pmatrix}$$

For each of the cases below, find the force on a surface of area dA at the specified location and orientation.

- (a) At the point (1, 1, 0) and oriented in the $+\hat{\mathbf{x}}$ direction.
- (b) At the point (1, 1, 0) and oriented in the $+\hat{\mathbf{z}}$ direction.
- (c) At the point (0, 1, 0) and oriented in the $+\hat{\mathbf{y}}$ direction.
- (d) At the point (0, 1, 1) and oriented in the $\frac{1}{\sqrt{2}}(\hat{\mathbf{x}} + \hat{\mathbf{y}})$.
- (e) For each of (a)–(d) above, state whether there is a non-zero shear force or not.