Using (13) and (15), the axial stress σ_z becomes

$$\sigma_z = \sigma_r - \frac{2\,\bar{\sigma}}{3\,\bar{\epsilon}}\,(2\epsilon_r + \epsilon_\theta) \tag{19}$$

These last three equations can be combined with the two equilibruim equations, (11) and (12), to give

$$\frac{\partial \sigma_r}{\partial r} + \frac{2\,\bar{\sigma}}{3r\bar{\epsilon}}\,(\epsilon_r - \epsilon_\theta) + \frac{1}{3}\frac{\partial}{\partial z}\left(\frac{\bar{\sigma}}{\bar{\epsilon}}\,\gamma_{rz}\right) = 0 \tag{20}$$

$$\frac{1}{3}\frac{\partial}{\partial r}\left(\frac{\bar{\sigma}}{\bar{\epsilon}}\gamma_{rz}\right) + \frac{\partial \sigma_r}{\partial z} + \frac{\bar{\sigma}}{3r\bar{\epsilon}}\gamma_{rz} - \frac{2}{3}\frac{\partial}{\partial z}\left[\frac{\bar{\sigma}}{\bar{\epsilon}}\,(2\epsilon_r - \epsilon_\theta)\right] = 0 \tag{21}$$