

459.731 Theory of Poroelasticity

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1.

A rock sample in the size of $10\text{ m} \times 10\text{ m} \times 10\text{ m}$ is confined in both x- and y-directions with free surface (in z-direction). Calculate the stress and strain tensor when temperature was increased from 20°C to 80°C assuming that the initial strain and stress were zero. How much does the rock expand in the z-direction?

The parameters for the rock, which was determined from the laboratory are as follows; Elastic modulus: 50 GPa, Poisson's ratio: 0.25, Linear expansion coefficient: $0.7 \times 10^{-5} / ^\circ\text{C}$, Heat conductivity: $2.7\text{ W/m}^\circ\text{C}$.

You first need to derive the equations for strain and thermal stress for this boundary condition using Eq.(7.125) and Eq.(7.128) and calculate the six strain and stress component using the input parameters.