Deformation Of Elastic Solids Poroelasticity Biphasic Relation

Displacement u, w(relative fluid / solid) u^s, u^f $u = u^s, w = \phi^f (u^f - u^s)$

Strain Displacement
$$\varepsilon = \frac{\partial u}{\partial x}; \varsigma = \frac{\partial w}{\partial x}$$
 $\varepsilon^s = \frac{\partial u^s}{\partial x}; \varepsilon^f = \frac{\partial u^f}{\partial x}$ $\varepsilon = \varepsilon^s; \varsigma = \phi^f \left(\varepsilon^f - \varepsilon^s\right)$

 $\sigma_{ij} = \lambda \varepsilon_{ij} + 2\mu \varepsilon_{ij} + p\delta_{ij} \qquad \sigma_{ij}^{s} = \lambda^{s} \varepsilon_{ij}^{s} + 2\mu^{s} \varepsilon_{ij}^{s} + \alpha p\delta_{ij} \quad \lambda = \lambda^{s}; \mu = \mu^{s}; \alpha = \frac{\phi^{s}}{\phi^{f}}$

Stress-Strain

(Constitutive)

- Equilibrium
- $\frac{\partial \sigma_{ij}}{\partial x_j} = 0 \qquad \qquad \frac{\partial \sigma_{ij}^s}{\partial x_j} \frac{k_{ij}^{-1}}{\left(\phi^f\right)^2} \left(\frac{du_i^s}{dt} \frac{du_i^f}{dt}\right) = 0$ $k_{ij}\frac{\partial p}{\partial x_j} = \frac{dw_i}{dt}(DarcyLaw) \qquad \frac{\partial \sigma_{ij}^f}{\partial x_j} + \frac{k_{ij}^{-1}}{\left(\phi^f\right)^2} \left(\frac{du_i^s}{dt} \frac{du_i^f}{dt}\right) = 0$

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