

## Formulation for 3D

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For 3D,

$$i) \nabla \cdot \mathbf{S} - \rho_b \mathbf{g} = 0$$

$$ii) \boldsymbol{\varepsilon} = \frac{1}{2} [\nabla \mathbf{u} + (\nabla \mathbf{u})^T]$$

$$iii) \mathbf{S} = \boldsymbol{\sigma} + \alpha p \mathbf{I}$$

$$iv) \boldsymbol{\sigma} = \mathbf{C} : [\boldsymbol{\varepsilon} - \beta_r \Delta T \mathbf{I}]$$

$$\nabla \cdot \left\{ \mathbf{C} : \frac{1}{2} [\nabla \mathbf{u} + (\nabla \mathbf{u})^T] \right\} = - \nabla \cdot [\alpha p \mathbf{I} - \mathbf{C} : \beta_r \Delta T \mathbf{I}] + \rho_b \mathbf{g}$$