$$\begin{cases} \nabla\cdot\sigma = 0 & \text{in } \Omega \\ \underset{\sim}{u} = \underset{\sim}{g} & \text{on } \Gamma_g \\ \sigma\cdot\underset{\sim}{n} = \underset{\sim}{h} & \text{on } \Gamma_h \\ J-1 = 0 & \text{in } \Omega \end{cases}$$

$$A(\overline{W}, \overline{U}; \beta) + R(\overline{W}, \overline{U}; \beta) = (\underset{\sim}{w}, \underset{\sim}{h})_{\Gamma_h} \qquad \overline{W} \equiv [\underset{\sim}{w}, q]$$

$$\overline{U} \equiv [\underset{\sim}{u}, p]$$

$$A(\overline{W}, \overline{U}; \beta) = \int_v w_{i,j}\,\sigma_{ij}\,dv + \int_v (J-1)\,q\,dv$$

$$R(\overline{W}, \overline{U}; \beta) = \sum^{n_{el}} \int_{v^e} \tau\, p_{,i}\, q_{,i}\, dv$$

$$\sigma = \frac{1}{J} F S F^T, \qquad S = -pJC^{-1} + 2\frac{\partial W}{\partial C}, \qquad W = \frac{\mu}{2r}\left(e^{r(J^{-2/3} I_1 - 3)} - 1\right)$$

$$x = X + \underset{\sim}{u} \Rightarrow \frac{\partial x}{\partial x} = \frac{\partial X}{\partial x} + \frac{\partial u}{\partial x} \Rightarrow I = F^{-1} + \frac{\partial \underset{\sim}{u}}{\partial x} \Rightarrow F = \left(I - \frac{\partial \underset{\sim}{u}}{\partial x}\right)^{-1}$$

$$\lim_{\epsilon\to 0}\frac{d}{d\epsilon} A(\overline{W}, \overline{U} + \epsilon\Delta\overline{U}; \beta) = \int_v w_{i,j}\,(\delta_{ik}\sigma_{jl} + c_{ijkl})\,\Delta u_{k,l}\,dv$$

$$+ \int_v q J F^{-T}_{ij}\,\Delta u_{i,j}\,dv$$

$$- \int_v w_{i,j}\,\Delta p\,dv$$

$$\lim_{\epsilon\to 0}\frac{d}{d\epsilon} R(\overline{W}, \overline{U} + \epsilon\Delta\overline{U}; \beta) = \sum^{n_{el}} \int_{v^e} q_{,i}\,\Delta p_{,i}\,dv$$

$$c_{ijkl} = C_{IJKL}\cdot F_{iI} F_{jJ} F_{kK} F_{lL}\cdot\frac{1}{J}.$$

$$C_{IJKL} = 2\frac{\partial S_{IJ}}{\partial C_{KL}} = 4\frac{\partial^2 W}{\partial C_{IJ}\partial C_{KL}} - 2\frac{\partial}{\partial_{KL}}(pJC^{-1}_{IJ})$$

$$= 2\mu e^{r(J^{-2/3}I_1 - 3)}\left(rL_{IJ}L_{KL} - \frac{1}{3}L_{IJ}C^{-1}_{KL} + D_{IJKL}\right) - 4p\frac{\partial^2 J}{\partial C_{IJ}\partial C_{KL}}$$

$$L_{IJ} = J^{-2/3}\left(-\frac{1}{3}I_1 C^{-1}_{IJ} + \delta_{IJ}\right)$$

$$D_{IJKL} = -\frac{1}{3}J^{-2/3}\left(C^{-1}_{IJ}\delta_{KL} - \frac{1}{2}I_1\left(C^{-1}_{IK}C^{-1}_{JL} + C^{-1}_{IL}C^{-1}_{JK}\right)\right)$$

$$\frac{\partial^2 J}{\partial C_{IJ}\partial C_{KL}} = \frac{1}{4}J\left(C^{-1}_{IJ}C^{-1}_{KL} - C^{-1}_{IK}C^{-1}_{JL} - C^{-1}_{IL}C^{-1}_{JK}\right).$$