The thermal expansion coefficient is

$$\alpha = -\frac{1}{\rho}\frac{\partial \rho}{\partial \theta}\bigg|_{s,p} \qquad \rho(s,\theta,p) = \frac{\rho(s,\theta,0)\,K(s,\theta,p)}{K(s,\theta,p)-p}$$

$$\alpha = -\frac{(K-p)\frac{\partial}{\partial\theta}(\rho_0 K) - \rho_0 K \frac{\partial}{\partial\theta}(K-p)}{\rho(K-p)(K-p)}$$

$$= -\frac{(K-p)\left(\rho_0\frac{\partial K}{\partial\theta} + K\frac{\partial\rho_0}{\partial\theta}\right) - \rho_0 K\frac{\partial K}{\partial\theta}}{\rho(K-p)(K-p)}$$

$$= \frac{\frac{\partial\rho_0}{\partial\theta}(K^2-pK) - p\rho_0\frac{\partial K}{\partial\theta}}{\rho(K-p)(K-p)}$$

$$\alpha = -\frac{K(K-p)\frac{\partial\rho_0}{\partial\theta} - p\rho_0\frac{\partial K}{\partial\theta}}{\rho(K-p)(K-p)}$$

$$\alpha = -\frac{K(K+0.1z)\frac{\partial\rho_0}{\partial\theta} + 0.1z\rho_0\frac{\partial K}{\partial\theta}}{\rho(K+0.1z)^2}$$

The saline contraction coefficient is

$$\beta = \frac{1}{\rho}\frac{\partial \rho}{\partial s}\bigg|_{\theta,p}$$

$$\beta = \frac{(K-p)\frac{\partial}{\partial s}(\rho_0 K) - \rho_0 K\frac{\partial}{\partial s}(K-p)}{\rho(K-p)(K-p)}$$

$$= \frac{(K-p)\left(\rho_0\frac{\partial K}{\partial s} + K\frac{\partial\rho_0}{\partial s}\right) - \rho_0 K\frac{\partial K}{\partial s}}{\rho(K-p)(K-p)}$$

$$= \frac{\frac{\partial\rho_0}{\partial s}(K^2-pK) - p\rho_0\frac{\partial K}{\partial s}}{\rho(K-p)(K-p)}$$

$$\beta = \frac{K(K-p)\frac{\partial\rho_0}{\partial s} - p\rho_0\frac{\partial K}{\partial s}}{\rho(K-p)(K-p)}$$

$$\beta = \frac{K(K+0.1z)\frac{\partial\rho_0}{\partial s} + 0.1z\rho_0\frac{\partial K}{\partial s}}{\rho(K+0.1z)^2}$$