This computation works for a singe solution

These values are constants

$p_{atm} := 100kPa$

$q_c := 20MPa$

$q_{cN} := \frac{q_c}{p_{atm}}$ $\qquad q_{cN} = 200$

$\sigma'_{v\_bottom\_cptu} := 400kPa$ $\qquad \frac{\sigma'_{v\_bottom\_cptu}}{p_{atm}} = 4$

$FC := 50$

$k_{term} := e^{\left[1.63 - \frac{9.7}{FC+2} - \left(\frac{15.7}{FC+2}\right)^2\right]}$ $\qquad k_{term} = 3.866$

$$m_{parameter}(q_{c1Ncs}) := 1.338 - 0.249 \cdot (q_{c1Ncs})^{0.264}$$

$$C_N(q_{c1Ncs}) := \left| \begin{array}{l} \left(\frac{100kPa}{\sigma'_{v\_bottom\_cptu}}\right)^{m_{parameter}(q_{c1Ncs})} \text{ if } \left(\frac{100kPa}{\sigma'_{v\_bottom\_cptu}}\right)^{m_{parameter}(q_{c1Ncs})} \le 1.7 \\ 1.7 \text{ if } \left(\frac{100kPa}{\sigma'_{v\_bottom\_cptu}}\right)^{m_{parameter}(q_{c1Ncs})} > 1.7 \end{array} \right.$$

$$q_{c1N}(q_{c1Ncs}) := C_N(q_{c1Ncs}) \cdot q_{cN}$$

Initial guesses: $q_{c1Ncs} := 200$ $\Delta q_{c1N} := 0.5$

Given

$$q_{c1Ncs} = q_{c1N}(q_{c1Ncs}) + \Delta q_{c1N}$$

$$\Delta q_{c1N} = \left(11.9 + \frac{q_{c1N}(q_{c1Ncs})}{14.6}\right) \cdot k_{term}$$

$$\begin{pmatrix} q_{c1Ncs} \\ \Delta q_{c1N} \end{pmatrix} := \text{Find}(q_{c1Ncs}, \Delta q_{c1N})$$

$$\begin{pmatrix} q_{c1Ncs} \\ \Delta q_{c1N} \end{pmatrix} = \begin{pmatrix} 208.792 \\ 80.091 \end{pmatrix}$$

$$C_N(q_{c1Ncs}) = 0.644$$

$$q_{c1N}(q_{c1Ncs}) = 128.7$$

$$\frac{\sigma'_{v\_bottom\_cptu}}{p_{atm}} = 4$$