These values are contants

qc := 10MPa

σ′v_bottom_cptu := 200kPa

FC := 50

$q_c := 10 \cdot 10^6$ $\sigma_v := 200 \cdot 10^3$ $FC := 50$

Eleminate units to enable calculation.

These are the available equations

qc1Ncs := qc1N + Δqc1N

mparameter := 1.338 - 0.249×(qc1Ncs)0.264

$q_{c1N} = q_{cIN} + \Delta q_{cIN}$

$$C_N := \begin{cases} \left(\frac{100kPa}{\sigma'_{v\_bottom\_cptu}}\right)^{m_{parameter}} & \text{if } \left(\frac{100kPa}{\sigma'_{v\_bottom\_cptu}}\right)^{m_{parameter}} \le 1.7 \\ 1.7 & \text{if } \left(\frac{100kPa}{\sigma'_{v\_bottom\_cptu}}\right)^{m_{parameter}} > 1.7 \end{cases}$$

$m_p = 1.338 - 0.249 \cdot q_{cIN}^{.264}$

$\frac{100\ 10^3}{\sigma_v} = 0.5$

$$\Delta q_{c1N} := \left(11.9 + \frac{q_{c1N}}{14.6}\right) \cdot e^{\left[1.63 - \frac{9.7}{FC+2} - \left(\frac{15.7}{FC+2}\right)^2\right]}$$

$e^{\left(1.63 - \frac{9.7}{FC} - \frac{15.7}{FC}\right)^2} = 3.521$

$\frac{q_c}{14.6} = 6.849 \cdot 10^5$

$$q_{c1N} := C_N \cdot \frac{q_c}{100kPa}$$

$m_p := 1.338 - 0.249 \cdot q_c^{0.264} = -16.209$

$0.5^{-16.209} = 7.575 \cdot 10^4$

This variable is the one which should be solved q_{c1Ncs}

We might be able to do this by iteration. Define a sequence variable and initial starting values:

$i := 1..50$ $Cn_0 := 1.7$ $Mm_0 := m_p$ $dQ_0 := 0$ $QC_0 := q_c$

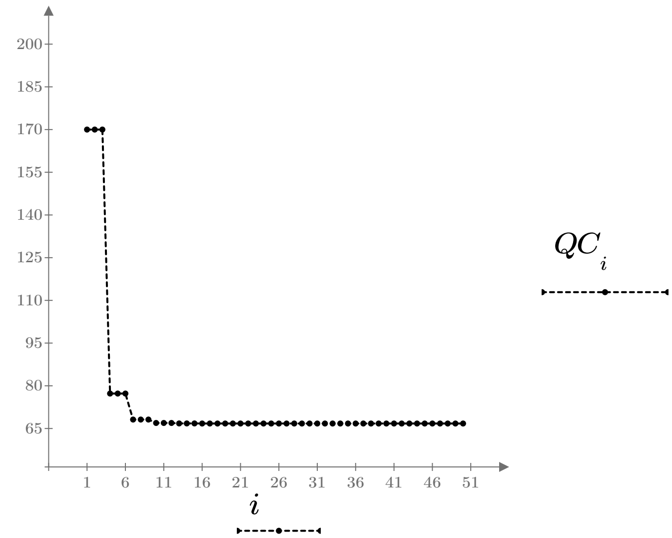
$$\begin{bmatrix} Cn_i \\ Mm_i \\ dQ_i \\ QC_i \end{bmatrix} := \begin{bmatrix} min\left(\begin{bmatrix} 1.7 \\ 0.5^{Mm_{i-1}} \end{bmatrix}\right) \\ 1.338 - 0.249 \cdot QC_{i-1}^{0.264} \\ \left(11.9 + \frac{QC_{i-1}}{14.6}\right) \cdot 3.521 \\ Cn_{i-1} \cdot \frac{QC_0}{100 \cdot 10^3} \end{bmatrix}$$

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

$QC_0 = 1 \cdot 10^7$

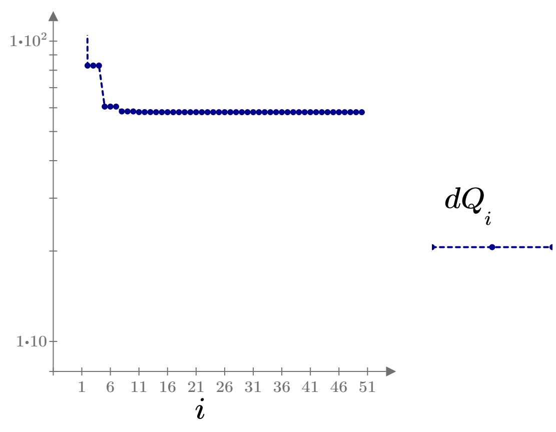
$QC_1 = 170$

$QC_2 = 170$



$min(QC) = 66.75$

$dQ_1 = 2.412 \cdot 10^6$



$dQ_2 = 82.898$

$dQ_3 = 82.898$

$dQ_{10} = 58.333$

$11.9 \cdot 3.521 = 41.9$