\[ P := 0.2 \quad E := 1.0 \quad X := 1.0 \quad j := \sqrt{-1} \]

\[ N_{\text{max}} := 20 \quad n := 0, 1..N_{\text{max}} \quad Q_{\text{lead}} := -0.2 \quad Q_{\text{lag}} := 0.21 \]

\[ Q_n := \frac{n}{N_{\text{max}}} (Q_{\text{lag}} - Q_{\text{lead}}) + Q_{\text{lead}} \quad V_{R_n} := 0.9 \quad \beta_n := 20\text{-deg} \]

Given

\[ P = \frac{E \cdot V_{R_n}}{X} \cdot \sin(\beta_n) \quad Q_n = \frac{E \cdot V_{R_n}}{X} \cdot \cos(\beta_n) = \left(\frac{V_{R_n}}{X}\right)^2 \]

\[ \begin{pmatrix} V_{R_n} \\ \beta_n \end{pmatrix} := \text{Find}(V_{R_n}, \beta_n) \quad V_{R_n} := V_{R_n} \cdot e^{-j \beta_n} \quad I_n := \frac{P - j \cdot Q_n}{V_{R_n}} \]

\[ N_{\text{max}2} := 20 \quad n := N_{\text{max}} + 1..N_{\text{max}} + N_{\text{max}2} \quad Q_{\text{lag}} := 0.20 \quad Q_{\text{lead}} := -0.2 \]

\[ Q_n := \frac{(n - N_{\text{max}})}{N_{\text{max}}} (Q_{\text{lead}} - Q_{\text{lag}}) + Q_{\text{lag}} \quad V_{R_n} := 0.3 \quad \beta_n := 120\text{-deg} \]

Given

\[ P = \frac{E \cdot V_{R_n}}{X} \cdot \sin(\beta_n) \quad Q_n = \frac{E \cdot V_{R_n}}{X} \cdot \cos(\beta_n) = \left(\frac{V_{R_n}}{X}\right)^2 \]

\[ \begin{pmatrix} V_{R_n} \\ \beta_n \end{pmatrix} := \text{Find}(V_{R_n}, \beta_n) \quad V_{R_n} := V_{R_n} \cdot e^{-j \beta_n} \quad I_n := \frac{P - j \cdot Q_n}{V_{R_n}} \]

\[ n := 0, 1..N_{\text{max}} + N_{\text{max}2} \]
Phasor Diagrams

\[ \text{arg}(V_{Rn}), \text{arg}(I_n) \]

Q-V Curves

Reactive Power (pu)

Magnitude of Receiving Voltage (pu)