Simple Switching Transients

Note Title 2/15/2014

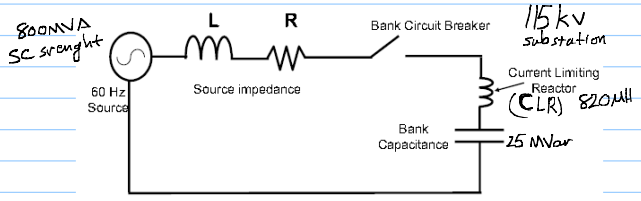
① Energizing a capacitor bank:

* L calculation:

$$MVA_{3\phi} = \frac{V_{LL}^2}{X_L}$$

$$X_L = \frac{V_{LL}^2}{MVA_{3\phi}} = \frac{(115k)^2}{800\,MVA} = 16.53\,\Omega$$

$$L = \frac{X_L}{2\pi f} = \frac{16.53}{377} = 43.85\,mH$$



* C calculation:

$$Mvar_{3\phi} = \frac{V_{LL}^2}{X_C}$$

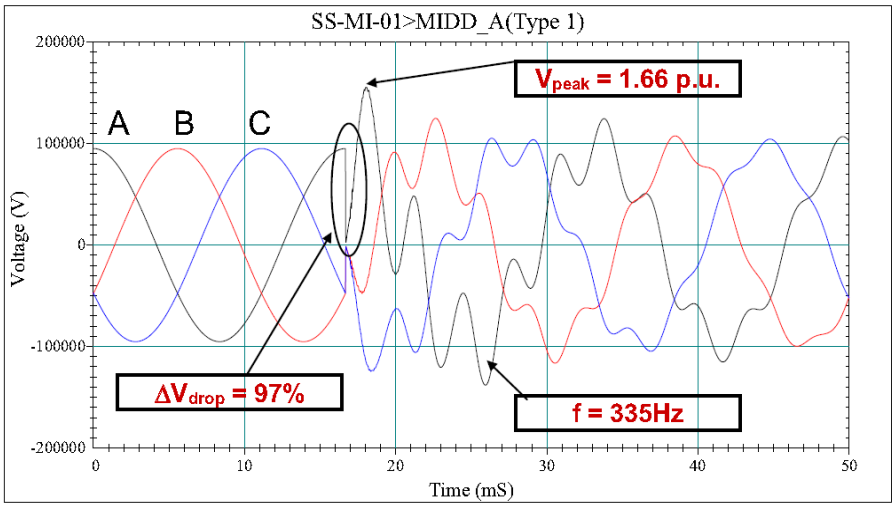
$$X_C = \frac{V_{LL}^2}{Mvar_{3\phi}} = \frac{(115k)^2}{25M} = 529\,\Omega$$

$$C = \frac{1}{2\pi f X_C} = \frac{1}{(377)(529)} = 5.01\,\mu F$$

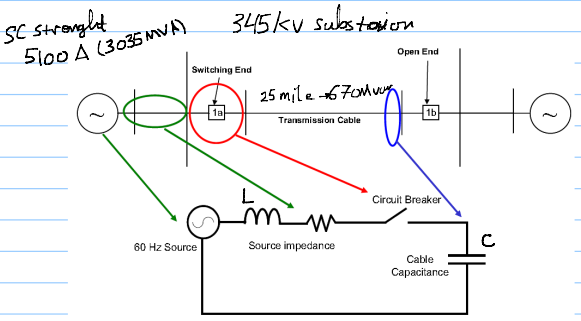
* Oscillation frequency calculation:

$$f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{(820\mu + 43.85m) * 5.01\mu}}$$

$$= 336\,Hz$$



② Energizing transmission cable:



* L calculation:

$$MVA_{3\phi} = \frac{V_{LL}^2}{X_L}$$

$$X_L = \frac{V_{LL}^2}{MVA_{3\phi}} = \frac{(345k)^2}{3035} = 39.2\ \Omega$$

$$L = \frac{X_L}{2\pi f} = \frac{39.2}{377} = 104\ mH$$

* C calculation:

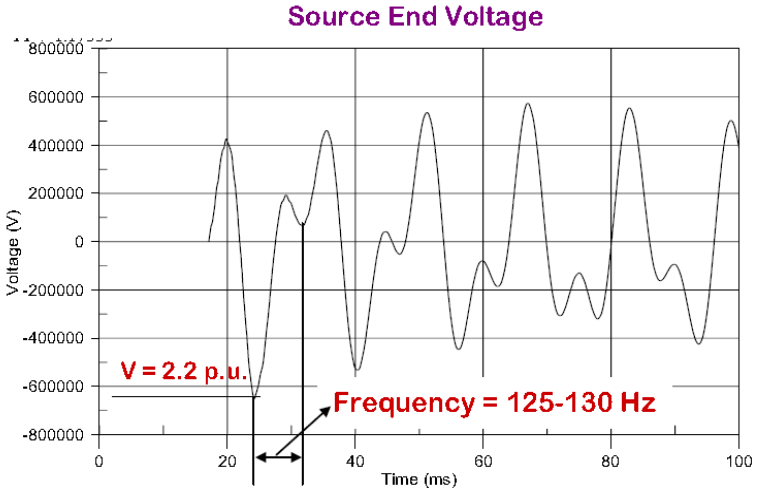
$$Mvar_{3\phi} = \frac{V_{LL}^2}{X_C}$$

$$X_C = \frac{V_{LL}^2}{Mvar} = \frac{(345k)^2}{670\ Mvar} = 177.6\ \Omega$$

$$C = \frac{1}{2\pi f X_C} = \frac{1}{(377)(177.6)} = 14.93\ \mu F$$

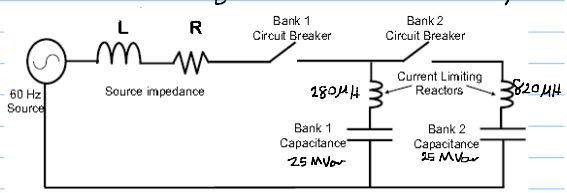
* Oscillation frequency calculation:

$$f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{(104m)(14.93\mu)}} = 128\ Hz$$



③ Energizing back-to-back capacitor banks:

6500 A SC strenght Level at the CB (115kv)



* L Calculation:

$$L_{eq} = L_{CLR_1} + L_{CLR_2}$$

$$= 280\mu H + 820\mu H = 1100\mu H$$

* C Calculation:

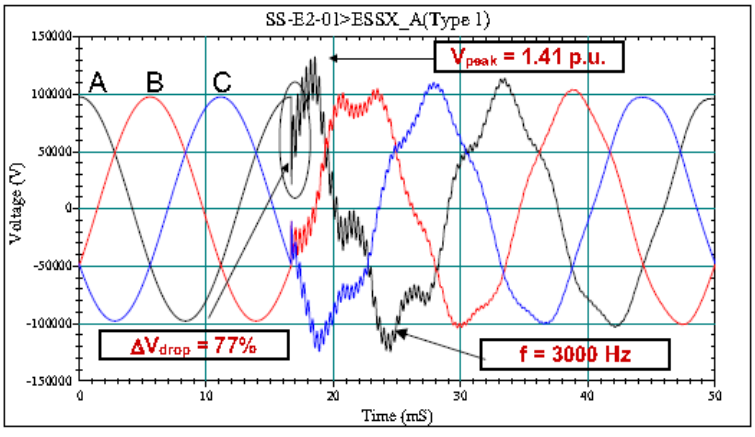
$$X_c = \frac{1}{2\pi f C} = \frac{V_{LL}^2}{MVar} = 529\,\Omega$$

$$C = \frac{1}{2\pi f X_c} = \frac{1}{(377)(529)} = 5.01\,\mu F$$

$$C_{eq} = \frac{C_1 C_2}{C_1 + C_2} = 2.505\,\mu F$$

* Oscillation frequency calculation:

$$f = \frac{1}{2\pi\sqrt{(1100\mu)(2.505\mu)}} = 3030\ Hz$$



④ Clearing a fault

Read sec. 3.3