Mutual impedance with communications lines

When a communication interference calculation is requested, the mutual impedances from the equivalent phase conductors 1,...N-1 to the N-th last equivalent phase conductor will be printed, as well as the impedance of the system of equivalent conductors Z_E. This is useful to study interference with communication lines, where the N-th equivalent phase conductor must represent the communication line (any type of conductor can be used for it, because the conductor type has no influence on mutual impedances). This arrangement is shown in Figure 1.

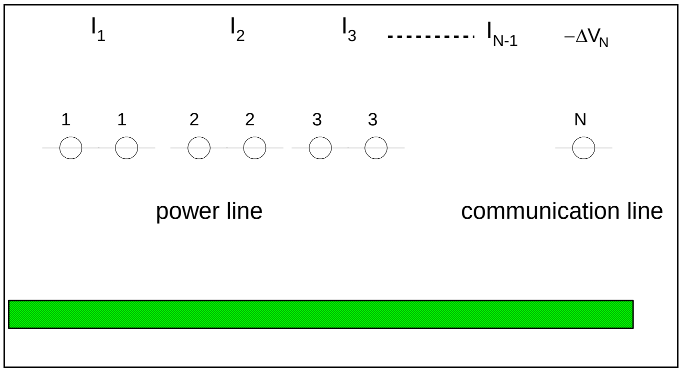

Figure 1 Interference between a power line and a communication line

The longitudinally induced voltage in the N-th equivalent phase conductor is given by:

$$-\Delta V_N = Z_{N,1} I_1 + Z_{N,2} I_2 + \cdots + Z_{N,N-1} I_{N-1}$$

In addition, it is assumed that equivalent phase conductors 1,2,3 belong to three-phase circuit I; 4,5,6 to three-phase circuit II, etc. The mutual impedances are then also given for currents expressed in symmetrical components, or

$$-\Delta V_N = Z_{zero,I} I_{zero,I} + Z_{pos,I} I_{pos,I} + Z_{neg,I} I_{neg,I}$$
$$Z_{zero,II} I_{zero,II} + Z_{pos,II} I_{pos,II} + Z_{neg,II} I_{neg,II} + \cdots$$

with $I_{zero,I}$, $I_{pos,I}$ and $I_{neg,I}$ being the zero, positive and negative sequence current of circuit **I**, etc…

The symmetrical components are unnormalized with:

$$\begin{bmatrix} I_{zero} \\ I_{pos} \\ I_{neg} \end{bmatrix} = \frac{1}{3} \begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix}$$

with $a = e^{j\frac{2\pi}{3}}$. For normalized symmetrical components, the factor in the above equation would be $\frac{1}{\sqrt{3}}$ instead of $\frac{1}{3}$.