Paris Session 2022

Impedance based methods for evaluation possible harmonic interactions

SC B4

PS1-4 – Harmonics and Filtering and interference in HVDC Applications

1.7Are there methodologies and approaches to analyze the possible harmonic interactions and predict the scenarios with harmonic interactions?

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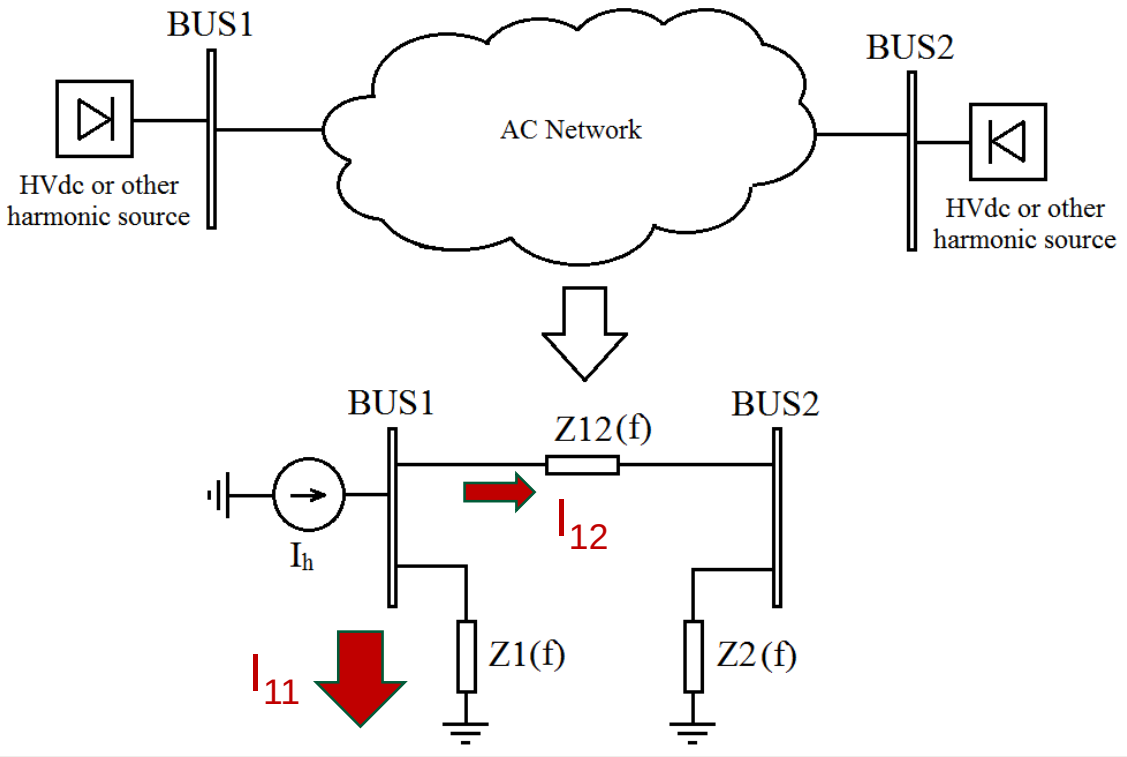
Analysis of Harmonic Interactions

- There is a well established procedure for evaluating harmonic performance of a device using **Harmonic Impedance Based Methods**.
- It would be good, if it is possible to expand the impedance based methods for evaluating the harmonic interactions between two devices.
- Multi-infeed Interaction factor (**MIIF**) is known for evaluating the fundamental frequency interactions.

Multi-infeed interaction factor for harmonic evaluation



$$MIIF(f) = \frac{\Delta V_2(f)}{\Delta V_1(f)} = \left| \frac{Z_2(f)}{Z_{12}(f) + Z_2(f)} \right|$$

- The limitation of this method is only the voltage ratio is considered and the current distribution (i.e. Z1) is not accounted.

Multi-infeed energy interaction factor for harmonic evaluation

- MIIF can be modified to consider the energy distribution

$$MIEIF(f) = \left|\frac{V_2(f)}{V_1(f)}\right| * \left|\frac{I_2(f)}{I_1(f)}\right| = = \left|\frac{Z_2(f)}{Z_{12}(f)+Z_2(f)}\right| * \left|\frac{Z_1(f)}{Z_1(f)+Z_2(f)+Z_{12}(f)}\right|$$

Method is summarized in:

N Denboer, C Karawita, M Mohaddes, Frequency scan based screening technique for harmonic interactions of HVDC systems, ACDC Conference,2017.