Introduction: The main idea of the AC/DC hybrid line is to replace an existing AC system by a HVDC system on the same tower. Consequently a DC system and several AC systems will be operated on the same tower. On those hybrid transmission lines the electromagnetic coupling causes interaction between those systems.

Computational Methods: The following Maxwell’s equations were used for simulations

\[ E = -\nabla V \quad \nabla \cdot J = -Q \quad J = \sigma E + \frac{dD}{dt} + J_e \]

Simulation model of an AC/DC-Hybrid line in 3D-Space: Conductors, ground wires, towers and insulators are considered

Results: Time domain simulations are performed for two different scenarios. The electrical field under the AC/DC hybrid line and the electrical potential along the HVDC insulator are taken into account.

Scenario 1: One bipolar HVDC system and two 380-kV HVAC systems.

Scenario 2: One monopolar HVDC system and two 380-kV HVAC systems.

Conclusions:
1. The electrical field under the transmission line is influenced by the different HVDC operation states.
2. The electrical potential along the insulators are influenced by the different HVDC operation states insignificantly.
3. On those hybrid transmission lines the electromagnetic coupling causes interaction between DC-system and AC-systems. The mutual influence can be of steady-state or transient type. In order to investigate the transient electromagnetic influences, the RF Module of COMSOL Multiphysics could be used.

References:
1. D. Potkrajac, S. Papenheim, M. Kizilcay: Three-dimensional FEM model of an AC/DC hybrid high voltage transmission line to analyze the electrical field along composite insulators, IPST Conference 2017, 26.06-29.06.2017, Seoul, Republic of Korea.