

Paris Session 2022



Real-Time simulation environments to
validate hierarchical control

Study Committee C6

PREFERENTIAL SUBJECT 3

AGGREGATED DER FOR ENHANCING RESILIENCE, RELIABILITY
AND ENERGY SECURITY OF DISTRIBUTION SYSTEMS

Question 3.8

- To what extent can methods and corresponding tools be (re-)used from AC-based approaches? -

-José Miguel Ramírez Scarpetta, Colombia-



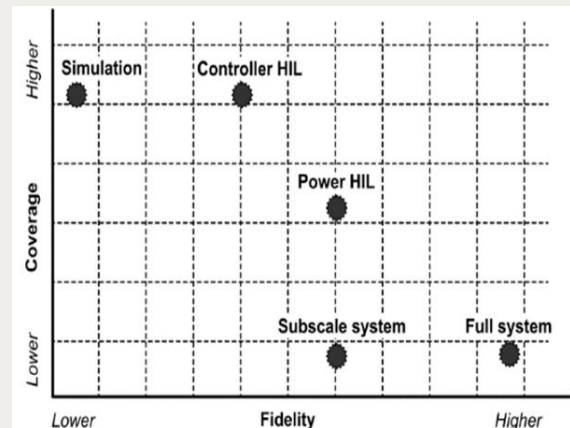
CONTROL SYSTEM IN AC AND DC MGs

- *To what extent can methods and corresponding tools be (re-)used from AC-based approaches?*
- It is required to control in a flexible and effective way any type of MG:
 - Flexibility: control the MG under various dynamic system configuration
 - Effectively: Maintaining the desired operation, searching for optimal performance and restoring after a failure
- AC and DC MGs share common:
 - Control requirements: voltage, current or power regulation, power sharing between DGs, Power Quality control, provision of ancillary services, participation in energy markets, minimization of operating cost...
 - Control strategies: drop control, cascade control, PID, MPC, consensus, etc.
- Due to the multiple functionalities required in different dynamic ranges, hierarchical control is used, which according to the communication channel can be centralized, decentralized or distributed.
- AC/DC MGs scale will be even greater in the coming years and its control functionalities will increase
- With hybrid integrated MGs, complex dynamic interactions appear that require:
 - Power system analysis software to simulate MG models
 - AC/DC analysis for power flows, stability, power quality , among others, under different scenarios
 - Best operation decision

Group Discussion Meeting

REAL -TIME SIMULATION ENVIRONMENTS TO VALIDATE HIERARCHICAL CONTROL SYSTEMS IN HYBRID MGs (DIGITAL TWIN)

- Software facilitates the desing and analysis of MG controllers
- Integrate advanced and low-level control laws
- Graphic construction of models
- Adding (in simple way) available block from the software to create new control strategies
- MG control system, based on the tests recommended by the IEEE 2030.8-2018:
 - Define test scenarios that allow testing central functions under representative and well- defined conditions.
 - Define performance measures that consider existing applicable standards.
 - Define the test environment, which involves from a fully simulated system to field installed equipment (RTS, HIL capabilities).
- DIGITAL TWINS: Allows to develop FAT (Factory Acceptance Test) in a real-time environment previously the MG enter to operate. However, there is a relationship between type of the test bank vs fidelity of the test:



Group Discussion Meeting

Thank you for your attention !