INTERPLAN

INTEgrated opeRation PLANning tool towards the pan-European network

Transforming Grid Operation Planning

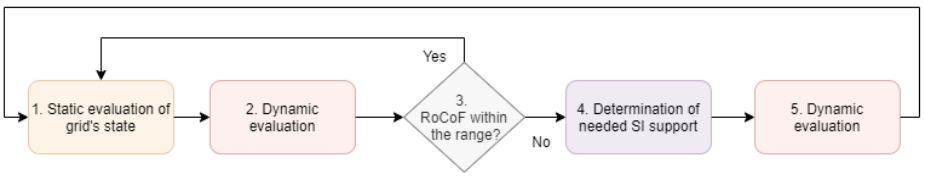
Use Case 6: Inertia management

Objective: Maintaining frequency stability in low inertia power system through limiting rate of change of frequency (RoCoF).

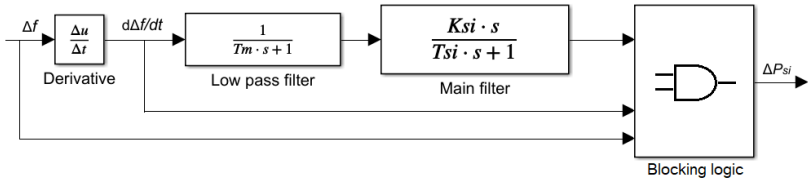
Network operation planning criteria: Assuring frequency stability.

Use case solution: For each time step in the operation planning period, the algorithm dynamically evaluates frequency stability in terms of biggest possible outage (based on forecasted grid state). If the required RoCoF is too high, the algorithm calculates the amount of necessary support in the form of synthetic inertia (SI). For this purpose, also a novel SI controller is proposed.

Use case diagram:



SI controller diagram:



Description:

Step 1: Grid model is initialized and forecasting data together with generation schedule are loaded.
Step 2 & 3: Frequency stability and possible need for additional inertial support are assessed for each step in the whole forecasting time window through a dynamic simulation.
Step 4 & 5: If needed, the synthetic inertia is activated in available units and dynamic simulation is performed in order to evaluate frequency stability with additional SI support.

Operation challenge:

- Frequency stability

Actors:

- TSO
- DSO
- Aggregator

Controllable units:

- Storage

Project duration
1 November 2017 - 31 January 2021

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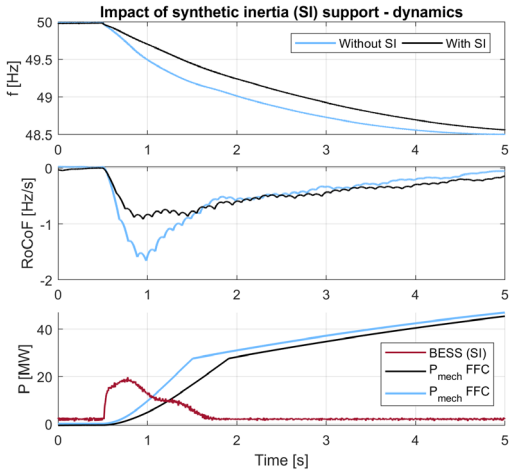
The key results of implementing use case 6 control functions:

Dynamic properties of SI control:

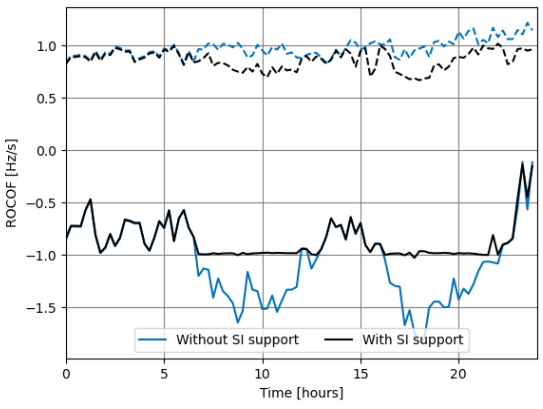
- These plots present the operation of the proposed synthetic inertia controller in response to the generation trip.
- Here, the SI controller is activated in the battery energy storage system (BESS) but in principle, it can operate in most fast-acting power sources.



- Two cases are compared: for the one without SI, high RoCoF can be expected should the generator trip happen. The activation of SI proves to limit RoCoF to the required level of 1 Hz/s. SI response is quick and fast-decaying so it can fill the gap before fast frequency control (FFC) comes into play.

Application of SI to operation planning with focus on inertia management:

- The amount of SI necessary to assure RoCoF limitation can be calculated in the operation planning phase.
- This diagram presents expected worst-case RoCoF values in the day-ahead planning window without and with the calculated SI support.



- The proposed inertia management algorithm informs the operation planner about the necessary amount of SI that should be deployed among available resources capable of providing such a service. This amount is variable in time and can be acquired using typical instruments, e.g. merit order.

INTERPLAN Tool Use Case 6:

Inertia management

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