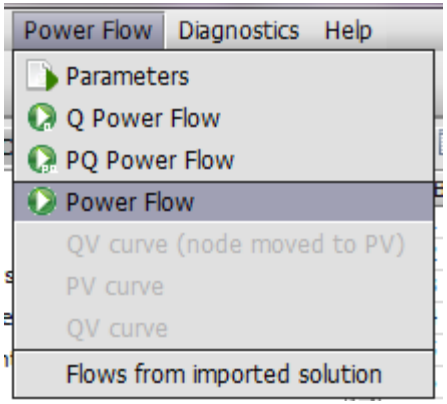
PQR HELM Powerflow

The Full Powerflow

Run a Standard Powerflow

The (full) Power Flow option is also called PQR-HELM powerflow, as opposed to Q-HELM or PQ-HELM.



First and last step analyzing a case

- When dealing with a new case, the first thing you should try is just running a standard (full) powerflow.
- If it does not have a solution, it is advised to first solve a Q-HELM powerflow. If it does not have a solution, there are severe "structural" problems to solve first (the reactive power flows are not feasible).
- If Q-HELM does have a solution but PQ-HELM does not, then there are problems of excessive real power flows.
- If PQ-HELM does have a solution but the full ("PQR") powerflow does not, there are also problems with excessive active power flows, but compounded by transmission losses. There might be some erroneous R parameters, for instance.

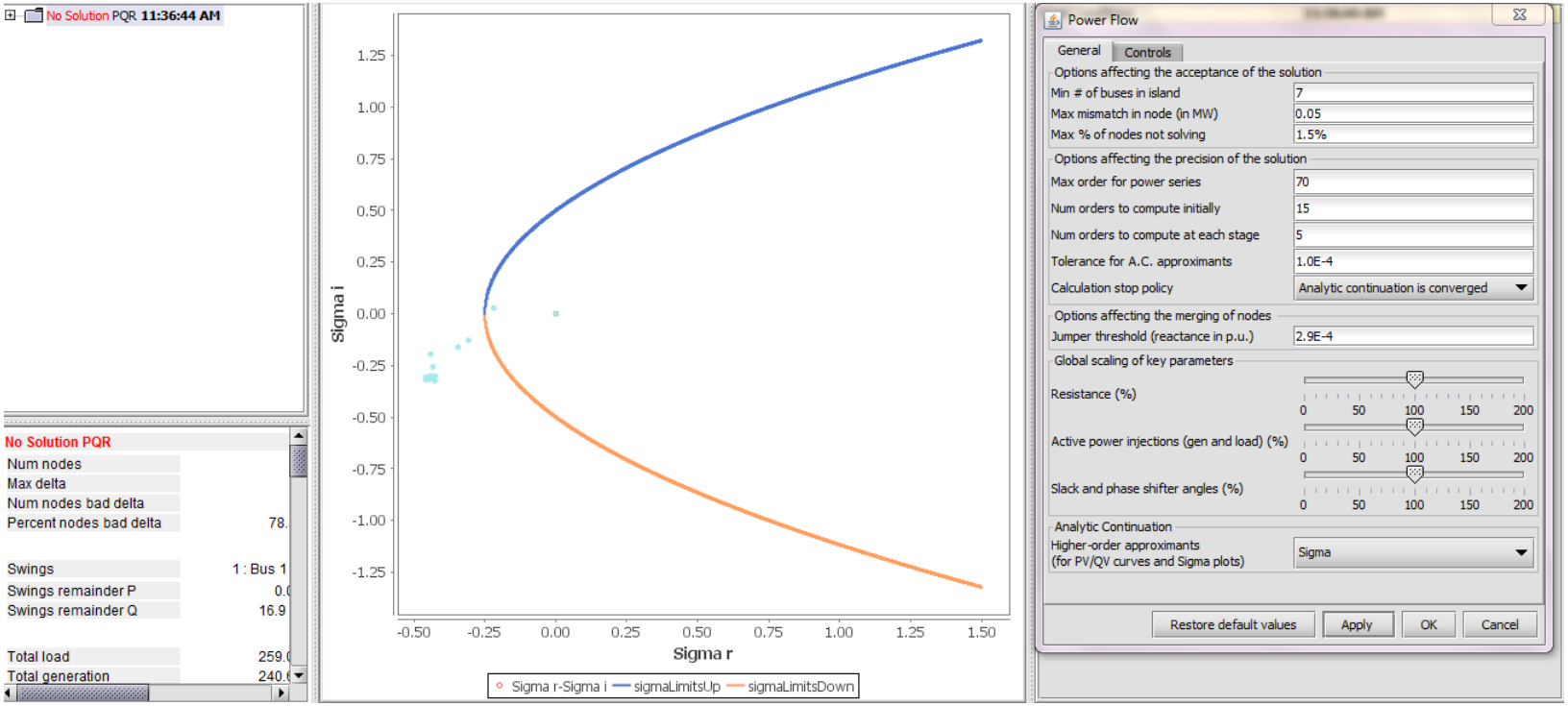
P, PQ, and Full Powerflow

Q-HELM ⟹ PQ-HELM ⟹ full-HELM

- If the full powerflow has a solution, then the PQ and Q powerflows also have a solution.
- The converse is not necessarily true.
- Note that voltages computed with full HELM are lower than voltages computed with PQ-HELM or Q-HELM (this is expected).

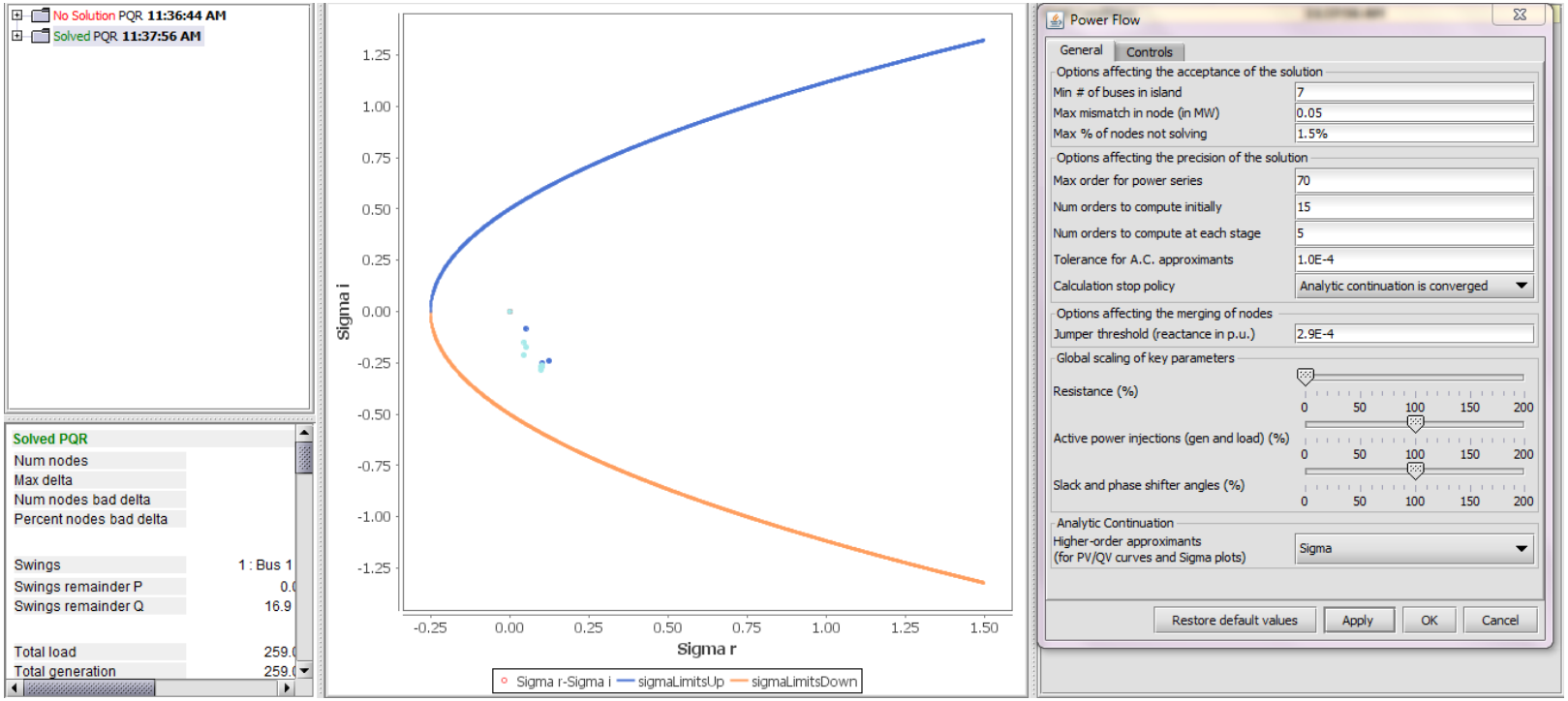
Introducing Gradually R

- R=100%: no solution (case is collapsed).



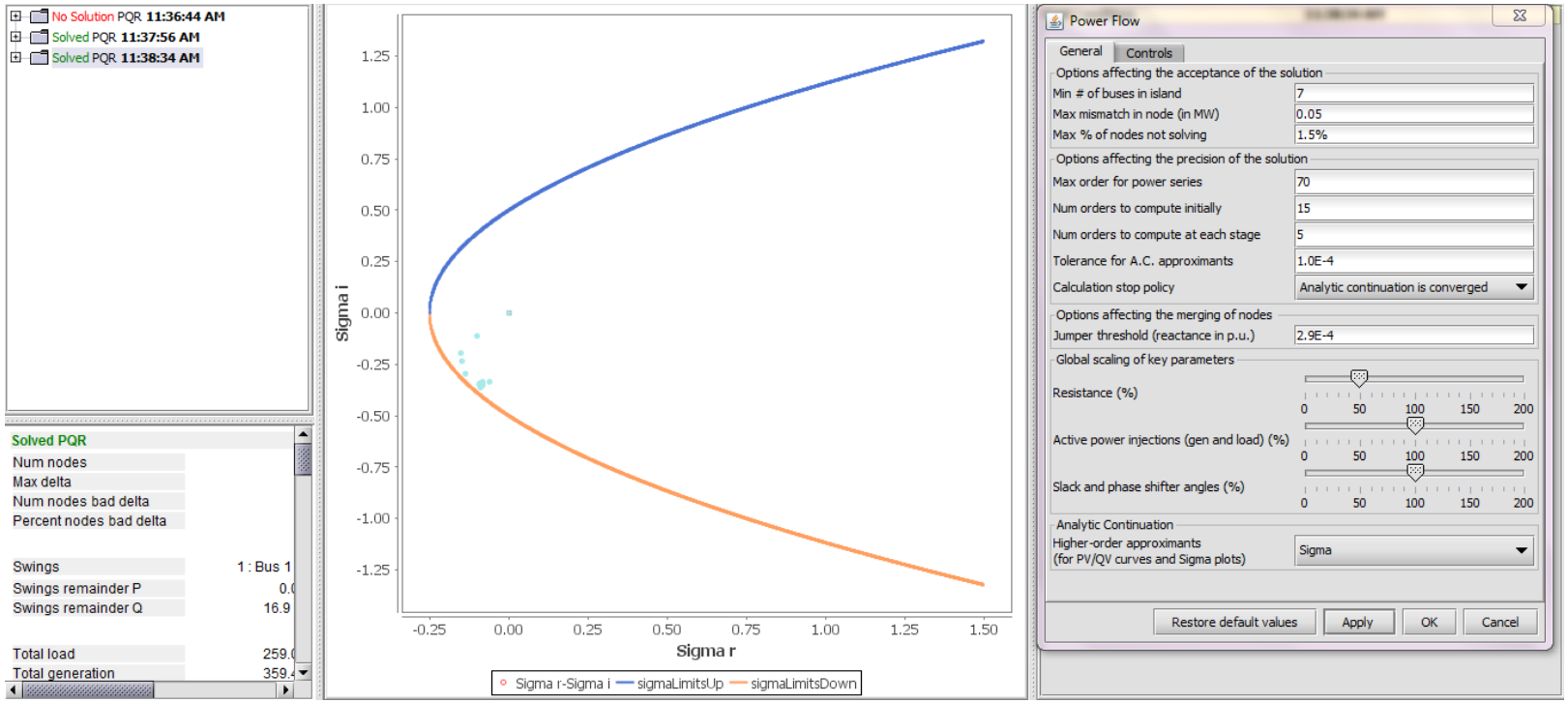
Introducing Gradually R

- R=0% --> just like a PQ power flow (except for angles). We obtain feasibility in this case.



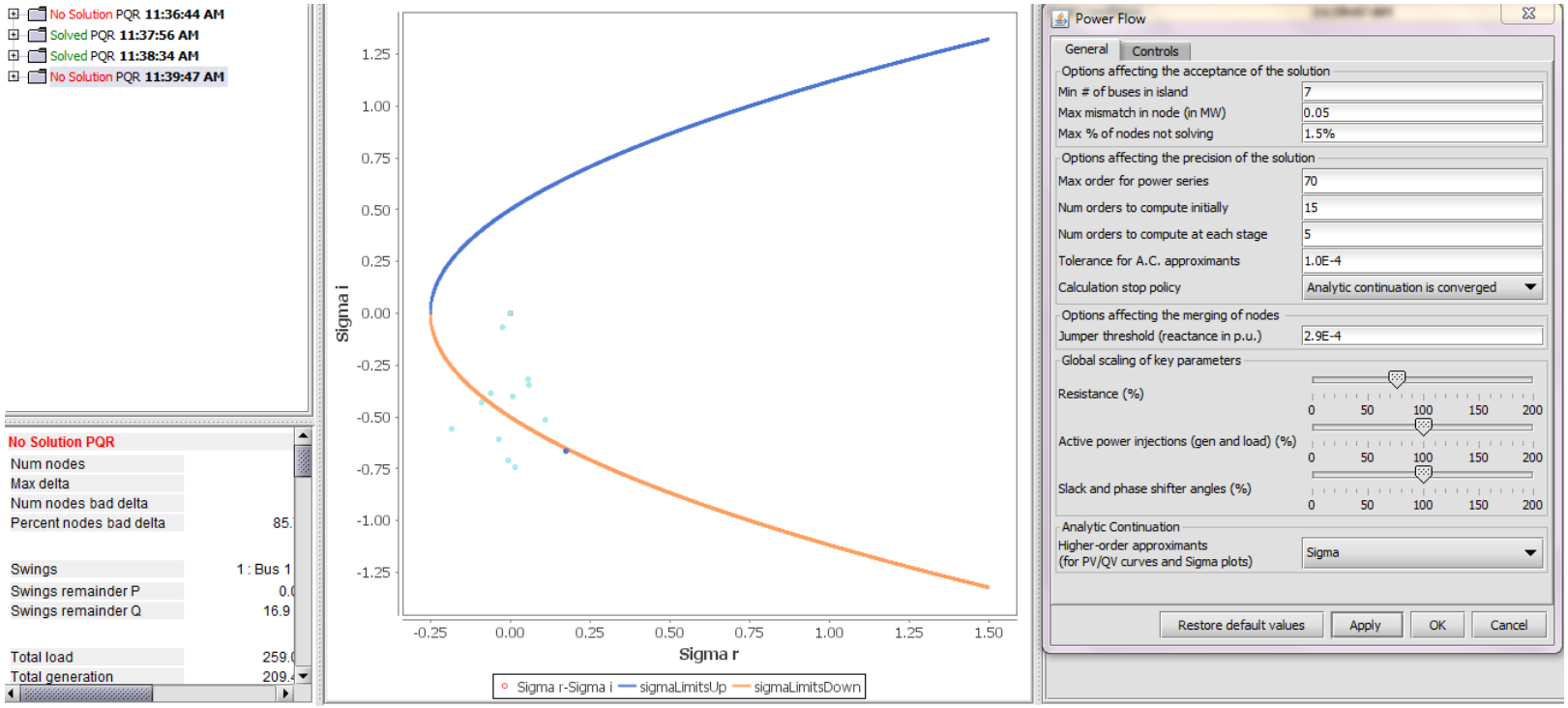
Introducing Gradually P

- R=50% : still solves.



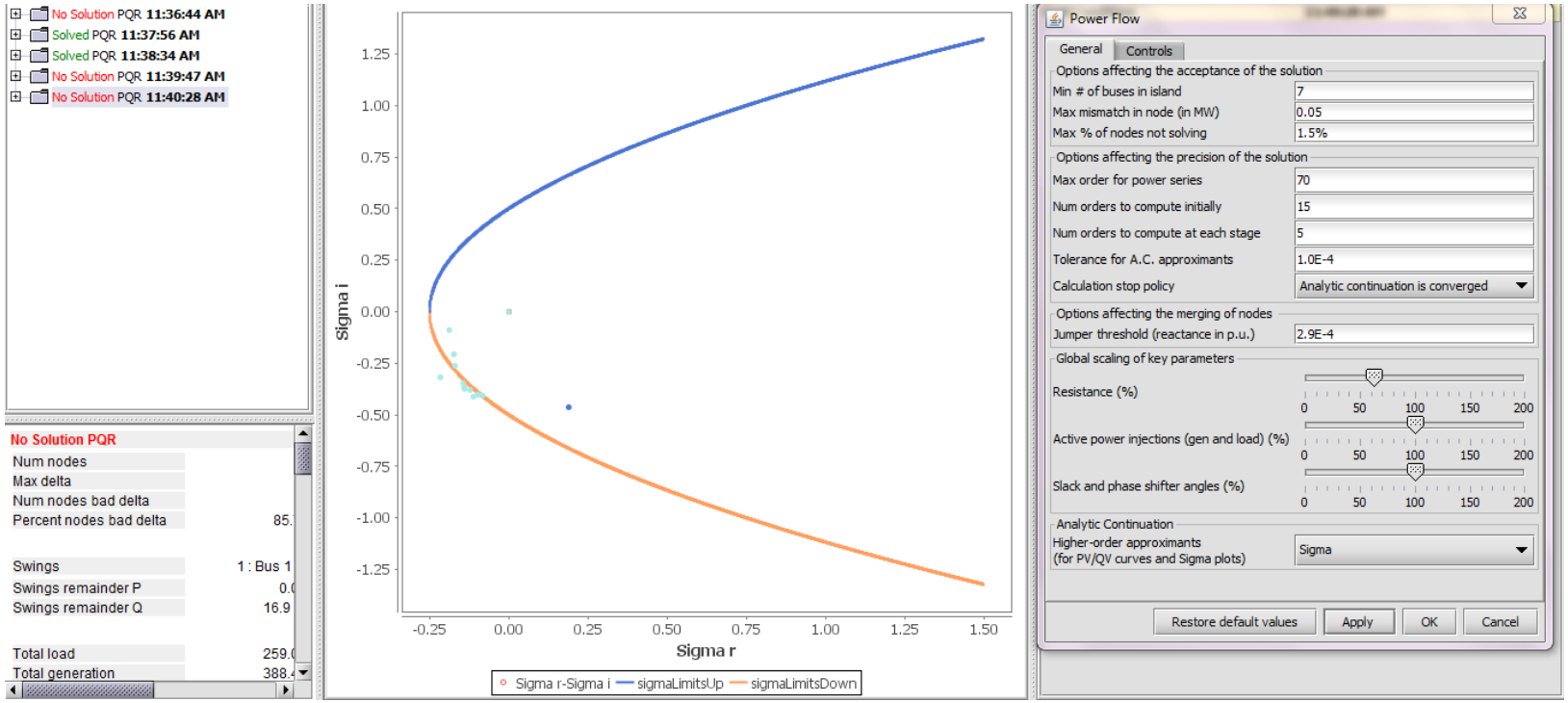
Introducing Gradually P

- R=75%: unfeasible.



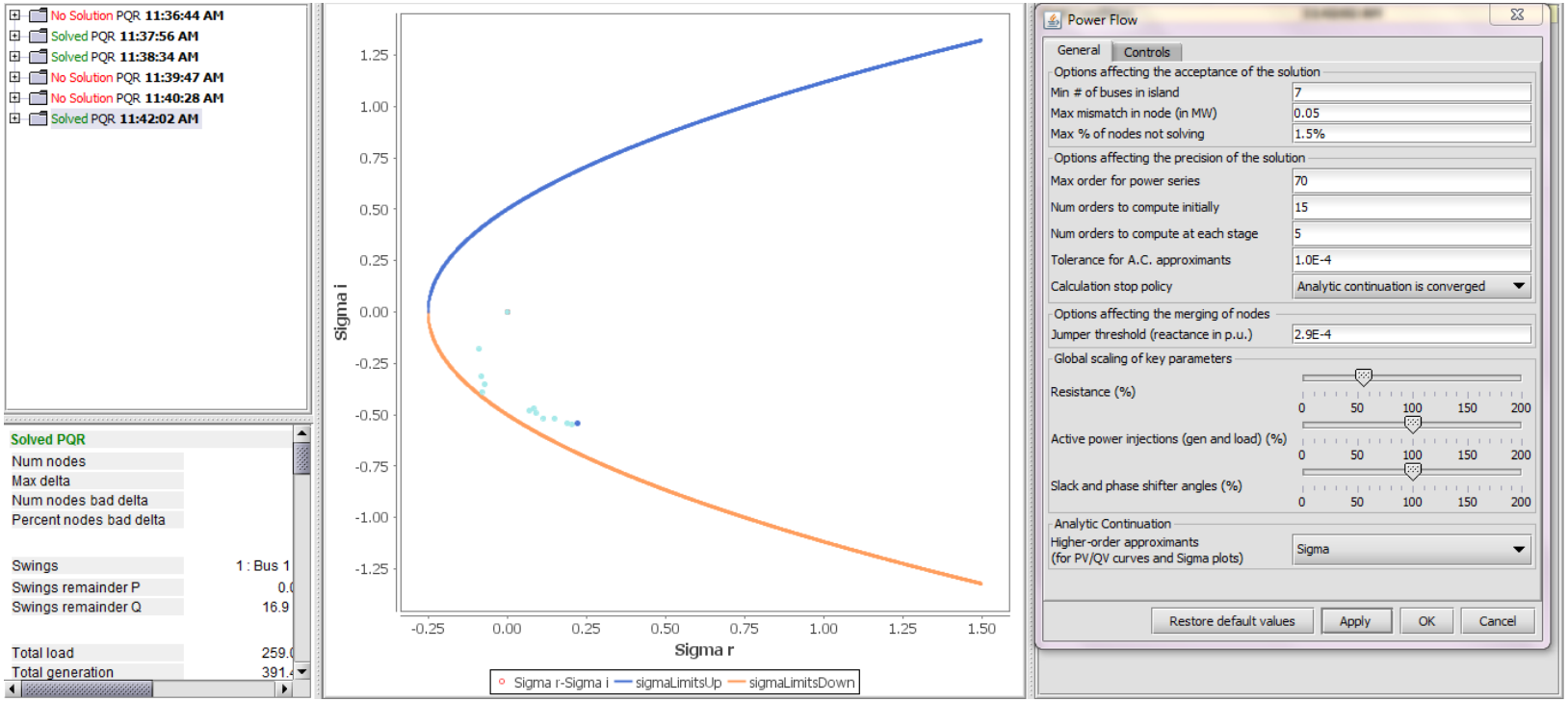
Introducing Gradually P

- R=60%: unfeasible.



Introducing Gradually P

- R=55%: feasible.



Lagrangian in the Full Powerflow

- Contrary to what happens for Q-HELM and PQ-HELM, the full powerflow problem does not admit a Lagrangian formulation.
- Remember that the Lagrangian allows one to define *a criterion* for the selection of the best configuration of saturated states, whenever there are several possible ones (as it is usually the case).
- But as resistive losses in transmission networks are small (compare I^2R vs. I^2X), it is plausible to propose that the optimal configuration of saturated controls in the PQ-HELM problem is also the “best” one for the full problem (actually, there is no rigorous definition for “best” in that case!).

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