Online Optimization in Closed Loop on the Power Flow Manifold

Dr Saverio Bolognani

ETH, Zurich

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Abstract:

I will show how most of the real-time control tasks in power systems (voltage regulation, economic re-dispatch, line congestion mitigation, etc.) can be reformulated as an online optimization problem on a nonlinear manifold. In contrast to the conventional approach where an optimal power flow solution is computed before being applied to the system, we aim at designing an adaptive feedback controller that steers the system in real time to the optimal operating point, while satisfying the operational constraints along its trajectory. I will present some of the theory that is needed in order to design such a controller. I will then discuss the main features of this solution, with a specific focus on robustness, feasibility, and tracking performance. Finally, I will discuss some practical aspects of the design and of the implementation of such a control scheme.