

Title: A Distributed Newton Method For Ensuring Feasible Power Delivery

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Sponsor: Nexans

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Description:

This project is motivated by the increased development of smart devices placed on transmission lines in the electric power system, such as dynamic line rating units (DLRs), which measure the thermal limit of transmission lines. Similarly, distributed series reactance devices (DSRs), which can change the reactance of transmission lines, and thereby directly control the corresponding power line flow. These devices can add economic value to the electric power system in their own ways; for example, DLRs can allow more power to be dispatched from the least expensive generators when scheduling, because there may be more capacity through congested transmission lines than suggested by the static line ratings (usually more conservative than the actual, measured line ratings). This economic benefit can be directly calculated and can justify whether such technology should be used in an electric power system.

However, the addition of this technology raises questions concerning the operations of the power system, such as if voltage stability can be maintained if power networks are operating with higher line flows. Because the steady state voltage stability is determined based on whether the power system has a power flow solution, our work focuses on creating an algorithm that can determine and ensure the feasibility of power flow solutions of an electric power system through cooperative distributed calculation by the devices deployed on the network.

We are developing an approach where, when new devices such as DLRs are deployed on an electric power system, they can cooperatively determine if the new operating conditions resulting from their use will lead to feasible power flow, as well as provide insight into how to adjust systems that fall out of this range, such as by changing the transmission line reactances by using available DSRs or other devices.