Master Project

AC Power Flow Problem: Search for an Efficient and Robust Solution

Duration: 4 months
Mentors: Prof. Olaf Schenk (USI), Juraj Kardos
Working place: Lugano, Switzerland

Prerequisites
The prerequisites for this MSc project are knowledge of Matlab and C/C++, and basic knowledge of parallel programming concepts.

The goal of this MSc project is to develop C++ code for solving the PF equations using the standard Newton method. The backbone C++ code will be provided, as well as the complete Matlab implementation as a reference. A series of experiments will be performed to demonstrate the sensitivity of the solution to the initial guess. The second part of the project is to reformulate the PF as a convex problem based on the methods proposed in the literature. The efficiency and robustness of the proposed approach will be analyzed through a number of test cases representing power grids of different sizes.

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Steady-state power flow (PF) analysis is a basis of power system planning and operation. Since the underlying physical equations that govern flows in power network are nonlinear, a closed-form solution of the AC power flow problem is not possible. Therefore, this problem is solved by numerical methods such as Newton-Raphson, which require a good starting point to converge to a solution. This means that if the solution algorithm does not converge, it is generally impossible to tell whether there is indeed no solution or the chosen starting point is not good enough. Such a situation is clearly undesirable because power grids are critical infrastructure and the algorithms used for their analysis and control must be as robust as possible. One potential way of addressing this challenge is the utilization of so-called convex relaxation techniques, which enable the application of fast and reliable solution algorithms to various problems arising in power system operation.

Contact information and application

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