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Stationary-state analysis of low-voltage DC grids
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Abstract
The optimal power flow is a classic method for alternating current networks, which can also be applied to direct current networks. However, it is needed to design new methods that guarantee convergence and global optimum. Several approximations based on Taylor series expansion linearization, recursive approximations, and convex optimization can be developed. In this chapter, we theoretically and numerically analyze approximations such as successive linear approximations, Newton-Raphson approximation, hyperbolic approximation, semidefinite programming, and second-order cone optimization for solving optimal power flow problems in direct current networks. The emphasis of the chapter is on low-voltage direct current grids (i.e., DC microgrids and DC distribution), but the ideas can be easily extended to high-power applications.

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