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# Load Frequency Control of Power Systems with Communication Delays

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***Abstract:***

Load Frequency Control (LFC) is a technique used to maintain the balance between generation and demand by regulating the power system's frequency, which is an indicator of the balance between generation and load. A decrease in frequency indicates that the power demand is higher than the current generation, while an increase in frequency indicates that the generation is higher than the demand. If the frequency is not kept in an acceptable range, it can cause power outages, equipment damage, etc. In this respect, LFC is important for power system stability and reliability. On the other hand, it is well known that each control system has time delays that can degrade system performance or even cause instability. Therefore, time delays must be taken into account in the analysis and design of LFC in order to achieve reliable and efficient power delivery. However, because of the existence of such delays, the design and analysis require advanced techniques. In this regard, the optimal control methods, based on the nonsmmoth and nonconvex optimization of spectral abscissa and H2/Hinf norm of the closed-loop system, are aimed to be utilized. Though these methods have been successfully applied to many control systems with time delays, no one has ever used it in LFC. By employing such methods, one can achieve the maximum exponential decay rate, which leads to the fastest rejection of frequency deviations in the power system, and trade-off between the performance and robustness. In order to illustrate the design and analysis phases of the study, numerical examples of the LFC of a multi-area power system with electrical vehicles are aimed to be employed. It should be shown that the designed systems are not only stable under certain communication delays but also reject the effect of frequency deviations as fast and reliable as possible. Thus, the reliability and efficiency of the power system must be guaranteed.

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