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# Combined Voltage and Frequency Control of Multi Area Power System using Sooty Tern Algorithm Optimized Cascade Controller

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### Abstract



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##### Abstract:

This work put forward the design of a sooty tern optimization algorithm (STOA) tuned cascaded proportional-integral and tilt-integral-derivative-filter (CPI-TIDF) for combined load frequency control and automatic voltage regulation (CLFC-AVR) of the interconnected power system (IPS). The CLFC-AVR analysis is initiated on laying 10% step load disturbance (10% SLD) on area-I of the considered power system. The supremacy of designed controller performance is deliberated with other widely accepted controllers. Moreover, the impact of AVR and its necessity of considering LFC are demonstrated. Further to enhance the CLFC-AVR performance territorial control strategy of battery energy storage (BES) and Thyristor controlled phase shifter (TCPS) devices are enacted with the system. Simulation analysis revealed a considerable improvement in CLFC-AVR performance with the BES-TCPS mechanism.

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I. Introduction

The most significant aspect of IPS is to extradite the quality of the power to the customer's end. The stable, economic, and reliable operation of IPS made the feasibility of delivering quality power to the demand side. The quality of the power is assessed in many ways and one such indicator is the supply frequency. The frequency of IPS fluctuates with the real power imbalance (RPI) [1] that emerges with the difference in real power demand and generation. The RPI is the major aspect that prominently affects the IPS frequency. Thus, collective efforts have to be made in regulating the RPI to ensure the frequency of IPS does not go beyond the specified limits. This can be achieved by the LFC by altering the generation units' operating point to meet the load demand. However, the terminal voltage asserting at a specified range is also the key indicator of the power quality. The LFC won't deal with the regulation of system terminal voltage and this can be addressed by the AVR. Thus, the LFC and AVR have to be addressed in a combined manner and the power quality indicators of frequency and voltage are to be regulated simultaneously.

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