

MOPSO-tuning of a threshold-based algorithm to start up and shut-down rapid-start units in AGC

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Abstract— Units within a frequency control area, participating in the automatic generation control (AGC) are usually spinning generating units already connected to the network and operating outside their range of optimal performance. This paper deals with an alternative method of providing secondary frequency control called Rapid-Start (RS) operation, consisting in assigning a regulation band to several off-line units (RS units) which are capable of being started and connected rapidly. As RS operation may have economic benefits (the on-line units operate closer to their optimal power level), an appropriate algorithm to start up and shut down RS units needs to be developed. This paper proposes a Threshold-Based Algorithm (TBA) that signals the start-up and shut-down decisions of RS-units based on two threshold parameters that measure the allowed distance of the regulating units of the control area to their operating limits. Total RS units cost and time of non-compliance of the control area are proposed as key performance indexes (KPIs) to measure the behavior of the algorithm. The two threshold parameters of the algorithm are tuned with a Multi-Objective Particle Swarm Optimization (MOPSO) algorithm that optimizes the KPIs. An AGC simulation model is developed to implement the MOPSO procedure and test the behaviour of the different parameter configurations. The performance of the whole methodology is illustrated for an actual secondary frequency control area within the Spanish power system.

Index Terms—

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