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Home > 2015 Autumn (October), Volume 13, Number 2 > **Precup**

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## Results on Optimal Tuning of Fuzzy Models of Magnetic Levitation Systems

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### Abstract

This paper presents some results related to the optimal tuning of fuzzy models of magnetic levitation systems as widely used nonlinear processes. A modeling approach is given. The Takagi-Sugeno fuzzy models of the process (which is first stabilized) are obtained by the modal equivalence principle, where the rule consequents contain the state-space models of the stabilized process linearized at important operating points. The optimization problems are focused on the minimization of objective functions defined as the mean square modeling error (i.e., the difference between the real-world process output and the fuzzy model output). The vector variables of the objective functions consist of a part of the parameters of the input membership functions of the fuzzy models. An operating point selection algorithm is inserted in the initial phase of the modeling approach. Several nature-inspired optimization algorithms are employed to solve the optimization problems that result in optimal fuzzy models, and Particle Swarm Optimization, Simulated Annealing and Gravitational Search Algorithms are exemplified.

### Keywords

fuzzy models, Gravitational Search Algorithms, magnetic levitation systems, objective functions, Particle Swarm Optimization, Simulated Annealing.

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