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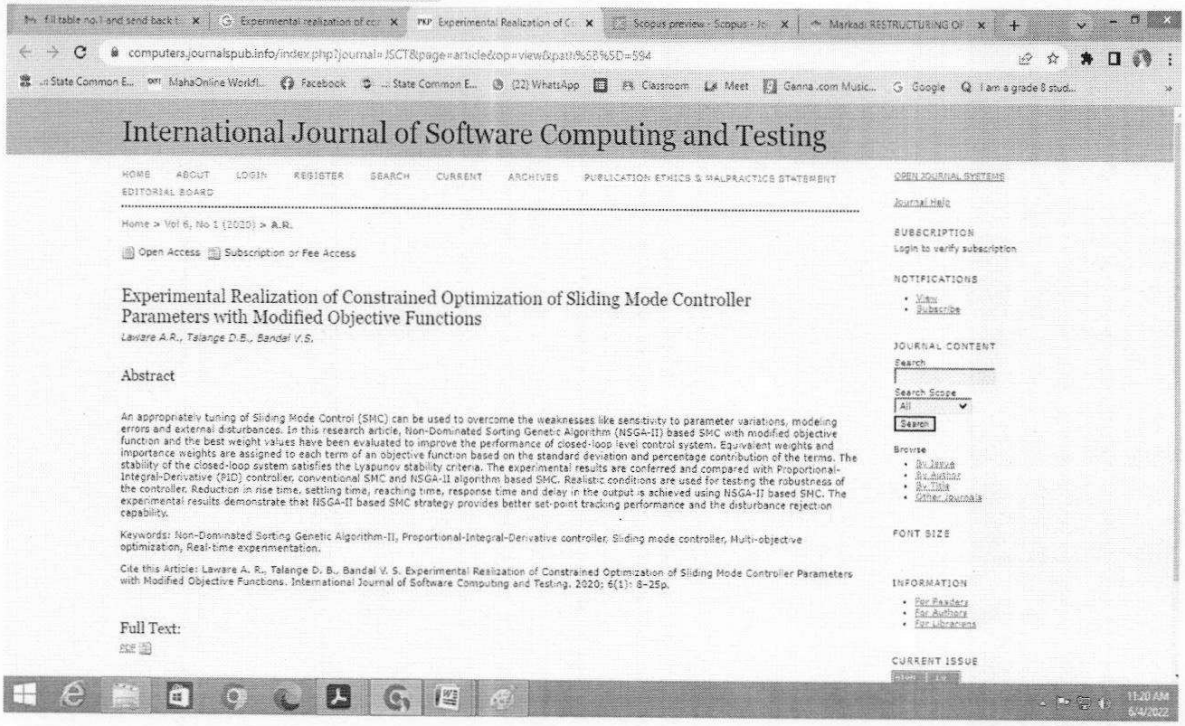
Date of Publication: - 6 August 2020
Academic Year of Publication 2019-20



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Experimental Realization of Constrained Optimization of Sliding Mode Controller Parameters with Modified Objective Functions

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Abstract

An appropriately tuning of Sliding Mode Control (SMC) can be used to overcome the weaknesses like sensitivity to parameter variations, modeling errors and external disturbances. In this research article, Non-Dominated Sorting Genetic Algorithm (NSGA-II) based SMC with modified objective function and the best weight values have been evaluated to improve the performance of closed-loop level control system. Equivalent weights and importance weights are assigned to each term of an objective function based on the standard deviation and percentage contribution of the terms. The stability of the closed-loop system satisfies the Lyapunov stability criteria. The experimental results are conferred and compared with Proportional-Integral-Derivative (PID) controller, conventional SMC and NSGA-II algorithm based SMC. Realistic conditions are used for testing the robustness of the controller. Reduction in rise time, settling time, reaching time, response time and delay in the output is achieved using NSGA-II based SMC. The experimental results demonstrate that NSGA-II based SMC strategy provides better set-point tracking performance and the disturbance rejection capability.

Keywords: Non-Dominated Sorting Genetic Algorithm-II, Proportional-Integral-Derivative controller, Sliding mode controller, Multi-objective optimization, Real-time experimentation.

Cite this Article: Laware A. R., Talange D. B., Bandal V. S. Experimental Realization of Constrained Optimization of Sliding Mode Controller Parameters with Modified Objective Functions. International Journal of Software Computing and Testing. 2020; 6(1): 8-25p.

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