

## Comparison of four evolutionary algorithms for optimization of holding force in a climbing robot



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### Abstract

Evolutionary algorithms (EAs) are stochastic search methods that mimic the natural biological evolution. In this work we provide an overview of four recent EAs and provide a framework for adoption in climbing robots. Four models based on EAs are introduced and compared for the optimization of the holding force in a Bernoulli holding pad for a climbing robot, by considering their important characteristics and their relevance to adaptive holding force. A brief code of each algorithm is presented to facilitate its implementation and use by researchers and practitioners. These EAs include the Differential Evolution (DE), MONEE implementation, Modified Genetic Algorithm (MGA) and the Memetic Algorithm (MA). The four EAs were applied to the popular MIT rule as objective function for the adaptive holding force, then to a real Bernoulli pad for climbing robot. MATLAB was employed for the rigorous comparison of the models in terms of the optimum solution obtained, the number of objective function evaluations corresponding to the optimum solution and the quality of the results. A statistical analysis was carried out and then an efficiency-rate metric was determined to assess the performance of each model. The results showed that the best performance came from a hybrid algorithm which incorporates desired characteristics for optimal holding force, thus a framework for adoption of EAs in climbing robots was developed.

### Biography

Masike R is a holder of a BEng degree in Industrial and Manufacturing Engineering and a MEng. Degree in manufacturing Engineering and Operations Management from NUST, Zimbabwe. She is currently studying towards a PhD in Robotics with Amity University Haryana, Gurgaon, India. She is the chairperson of the Industrial and Manufacturing Department at Harare Institute of Technology, Zimbabwe. She is the author of more than 10 articles and serves in the editorial boards of some reputable journals. Her research interests include Robotics, Automation and Artificial Intelligence. Masike R. is a dedicated and results-driven engineer and researcher who push the boundaries of engineering and innovation to give real life solutions to local and international problems through research and design methods.



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