PID Controller Design for Mobile Robot Using Bat Algorithm with Mutation (BAM)

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Abstract:
By definition, a mobile robot is a type of robot that has capability to move in a certain kind of environment and generally used to accomplish certain tasks with some degrees of freedom (DoF). Applications of mobile robots cover both industrial and domestic area. It may help to reduce risk to human being and to the environment. Mobile robot is expected to operate safely where it must stay away from hazards such as obstacles. Therefore, a controller needs to be designed to make the system robust and adaptive. In this study, PID controller is chosen to control a mobile robot. PID is considered as simple yet powerful controller for many kind of applications. In designing PID, user needs to set appropriate controller gain to achieve a desired performance of the control system, in terms of time response and its steady state error. Here, an optimization algorithm called Bat Algorithm with Mutation (BAM) is proposed to optimize the value of PID controller gain for mobile robot. This algorithm is compared with a wellknown optimization algorithm, Particle Swarm Optimization (PSO). The result shows that BAM has better performance compared to PSO in term of overshoot percentage and steady state error. BAM gives 2.29% of overshoot and 2.94% of steady state error. Meanwhile, PSO gives 3.07% of overshoot and 3.72% of steady state error.

Keywords: mobile robot; optimization algorithm; PID controller; Bat Algorithm with Mutation; Particle Swarm; Optimization

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