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Department	Electrical Engineering
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Thesis Title	"Improvement of Path Planning for Autonomous Mobile Robots Using Population-Based Optimization Algorithms "
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Abstract	Autonomous mobile robots are used in various applications such as dangerous regions. These applications demand robust and adaptable methods for path planning. Path planning optimization problem is a fundamental problem for robot navigation; its purpose is to find a collision-free path from the initial position to a target position. Many real-world optimization problems have become increasingly large, complex and dynamic, which require the development of methods and solutions whose efficiency is measured by their ability to find acceptable results within a reasonable amount of time. The Artificial Bee Colony (ABC) and Bacterial Foraging Optimization (BFO) algorithms are used for solving hard optimization problems, including path planning. BFO algorithm is a simple and powerful searching technique. On the other hand, Artificial Potential Field (APF) as a real time obstacle avoidance method is quite simple in theory, but it is easy to bring local minimum problem and failing to find a path in the narrow channel. Therefore, a method for hybridizing APF with BFO is introduced to make use of both methods' advantages. This thesis presents efficient and reliable four optimization algorithms to solve the path planning problem. The first two algorithms are developed based on ABC algorithm as global path planning; they specifically are modified version of ABC algorithm called Directed ABC (DABC) algorithm and a new fitness function added to ABC algorithm named Minimum Angles (MAABC) algorithm was developed. The other two algorithms were proposed based on BFO and APF algorithms as local path planning; they were namely enhanced versions of BFO algorithm with adaptive step size (ASBFO) algorithm and a proposed version of BFO algorithm with an adaptive tumble (ATBFO) algorithm. The developed algorithms were simulated using MATLAB R2011b package. The simulation results showed that these algorithms could find the shortest paths for even crowded environments. Moreover, these algorithms were compared with other researchers' work to evaluate their performance. Additionally, a comparison was made between the executing time of the proposed local path planning algorithms (ASBFO and ATBFO algorithms) and the real tracked military robot (e.g., Talon) to verify the capability of the proposed methods. Both algorithms achieved fast run time, approximately three times faster than Talon for complex environment, which made them practically efficient.