Mobile robot path navigation in static indoor environment via AOR 9-point laplacian iteration numerical technique

Abstract

Mobile robot path navigation is a crucial subject in robotics research and development. The navigation efficiency of a robot correlates directly with its overall performance. With persistent technological growth, the improvement potentials for autonomous robotic remains vast. The objective of this paper is to investigate the performance of the iteration technique called Accelerated Overrelaxation 9-Point (AOR-9P) Laplacian in enabling path navigation for mobile robots. This technique is a derivation from Laplace's equation which is used to calculate the potential fields in the 2-dimensional configuration space representation of an environment. The robotic path navigations are performed in a simulation called Robot 2D Simulator, written in Delphi Project software. After obtaining the solutions generated through AOR-9P iterative technique, the Gradient Descent Search (GDS) technique is employed to determine the best path for the mobile robot to traverse on. The performance of AOR-9P is examined by comparing the number of iterations needed to complete the navigation process. Results shown that AOR-9P enabled path navigation requires the least number of iterations to complete, thus having better performance than its predecessor techniques. In the same time, the paths produced are generally smooth and unobstructed all the way towards the goal point. For future improvements, it is recommended that the Half-Sweep (HS) and Quarter-Sweep (QS) approach to be introduced on AOR-9P iteration technique to improve its performance in solving the mobile robot path navigation problem.