

## LOCALIZATION OF MOBILE ROBOTS VIA AN ENHANCED PARTICLE FILTER INCORPORATING TOURNAMENT SELECTION AND NELDER-MEAD SIMPLEX SEARCH

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**ABSTRACT.** *A localization method based on an enhanced particle filter incorporating tournament selection and Nelder-Mead simplex search (NM-EPF) for autonomous mobile robots navigating in a soccer robot game field is proposed in this paper. To analyze the environment, an omnidirectional vision device is mounted on top of the robot. Through detecting the white boundary lines relative to the robot in the game field, weighting for each particle representing the robot's pose can be iteratively updated via the proposed NM-EPF algorithm. Thanks to the hybridization effect of the NM-EPF, particles converge to the actual position of the robot in a responsive way while tackling uncertainties. Simulation and experiment results have confirmed that the proposed NM-EPF has better localization performance in the soccer robot game field in comparison to the conventional particle filter.*

**Keywords:** Particle filter, Nelder-mead simplex search, Tournament selection, Robot localization, Soccer robot, Omnidirectional vision

**1. Introduction.** When a mobile robot moves through an environment, its actual position and orientation always differ from the position and orientation that it is commanded to hold mainly due to wheel slippage and location uncertainty [1,2]. To execute missions given to the robot, it is critically important for the robot to perceive its position in the field.

To estimate the position of the robot, sensing devices, for example, infrared sensors, ultrasonic sensors [3-5], laser range sensors [6], vision sensors, etc., are installed on the robot to explore the environment. Because of advantages in providing a rich source of environment information, vision sensors are becoming more and more popular in various applications. Many research works investigating the localization of robots mounted with cameras for sensing the environment have been conducted [7]. Because image processing is generally time-consuming, high-speed processors are required for improving computational efficiency. Thanks to the advances of embedded systems and computer hardware,