

# Neuro-Analogical Gate Tuning of Trajectory Data Fusion for a Mecanum-Wheeled Special Needs chair

Ahmed K. El-Shenawy\*<sup>1</sup>, M.A.EISaharty<sup>1</sup>, Ezz Eldin zakzouk<sup>1</sup>,

<sup>1</sup> Arab Academy for Science, Technology and Maritime Transport, Electric and Control Department, College of Engineering and Technology, Alexandria, Egypt.

\* ahmed.elshenawy@aast.edu

## Abstract

Trajectory tracking of mobile wheeled chairs using internal shaft encoder and inertia measurement unit(IMU), exhibits several complications and accumulated errors in the tracking process due to wheel slippage, offset drift and integration approximations. These errors can be realized when comparing localization results from such sensors with a camera tracking system. In long trajectory tracking, such errors can accumulate and result in significant deviations which make data from these sensors unreliable for tracking. Meanwhile the utilization of an external camera tracking system is not always a feasible solution depending on the implementation environment. This paper presents a novel sensor fusion method that combines the measurements of internal sensors to accurately predict the location of the wheeled chair in an environment. The method introduces a new analogical OR gate structured with tuned parameters using multi-layer feedforward neural network denoted as “Neuro-Analogical Gate” (NAG). The resulting system minimize any deviation error caused by the sensors, thus accurately tracking the wheeled chair location without the requirement of an external camera tracking system. The fusion methodology has been tested with a prototype Mecanum wheel-based chair, and significant improvement over tracking response, error and performance has been observed.