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Mathematical Modelling and Dynamic Controlling of an Autonomous Surface Vessel for Fresh Water Applications

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An Autonomous Surface Vessel (ASV) can be defined as a vehicle controlling its own steeringand speed for navigation, dynamic positioning, motion stabilization, obstacle detectionand avoidance. ASV model has been developed here will be practically deployed in one of research project of the department of mechanical and manufacturing engineering, University of Ruhuna for developing an automated weed harvesting boat for fresh water reservoirs in Sri Lanka. The main objective of this research is development of a mathematical model for a surface vessel by analyzing hydrodynamic forces that will further used to design online-learning adaptive controller for path tracking. A model-based shape adaptive neural network controller is developed by blending a self-adaptive neural network module and a classical Proportional plus Derivative (PD)-like control to obtain optimum control performance by complementing each other. The adaptive neural module counteracts for inherent model discrepancies, strong nonlinearities and coupling effects.

Keywords: autonomous surface vessel, RBF neural networks, PD controllers, vessel control, vessel dynamics