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A GREENHOUSE NEURAL CONTROL USING GENERALIZED AND SPECIALIZED LEARNING

Fathi Fourati and Mohamed Chtourou

Intelligent Control, Optimization and Design of Complex Systems (ICOS)
ENIS, B.P. W, 3038 Sfax, Tunisia
Fethi.Fourati@ipeis.rnu.tn; Mohamed.Chtourou@enis.rnu.tn

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Abstract. *In order to improve the control quality of a greenhouse, we put emphasis in this paper on, neural control strategies based on an online training. In fact, after an offline learning, the trained neural controller is applied, to provide control actions to the greenhouse using an online learning. These control strategies consist on the adjustment of the controller parameters (connection weights) with a generalized and a specialized learning. These kinds of control with further training allow to enrich the learning controller database with new situations and to improve the control phase.*
Keywords: Greenhouse, Neural networks, Neural model, Neural controller, Generalized learning, Specialized learning

1. **Introduction.** Modern agriculture is subjected to regulations in terms of quality and environmental impact. Thus, it is a field where the application of automatic control techniques has increased substantially during the last years. Monitoring and control of the greenhouse environment play a decisive role in greenhouse production processes. Fundamental to the success of modern agribusiness is efficient production management, high productivity and improved product quality. To bring this about, it is necessary to employ new and improved approaches to greenhouse environment control since traditional techniques can no longer be relied on to meet these demands. To cover these needs, it is therefore, necessary to perfect the greenhouses climate that depends essentially from the interdependence of temperature and humidity in order to maintain the cultures in the conditions that are compatible with the agriculturist's agronomic and the economic objective. These make greenhouse a complex process that attracts researchers to invest in modeling and control. Last years, there were many works developed in this way. We take examples in [1], the authors described the application of model predictive control (MPC) for temperature regulation in agricultural processes (a greenhouse). The MPC algorithm used here takes in account the constraints in both manipulated and controlled variables using an online linearization with a very low computational burden. In [2], the authors proposed an application of fuzzy logic to identify and control multi-dimensional systems. They described a method to reduce the complexity of a fuzzy controller and they showed an application on a real system (a greenhouse). In [3], there was a development of techniques of modeling and identification of a greenhouse based on fuzzy logic using fuzzy clustering technique to determine both the premises and the consequent parameters of the fuzzy Takagi-Sugeno rules. In [4], there was a use of neural networks to model and to control a greenhouse, therefore, a recurrent neural network based on an Elman structure was trained to emulate the direct dynamics of the greenhouse and used as a greenhouse model and a multilayer feed-forward neural network trained to emulate the inverse dynamics of the considered greenhouse was applied as a controller to provide the control