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CONSTRAINED NEURAL CONTROL FOR THE ADAPTIVE TRACKING OF POWER PROFILES IN A TRIGA REACTOR

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Abstract. *In this study, a control scheme to accomplish the tracking of power profiles in a TRIGA Reactor is presented. This scheme permits the fulfillment of the inverse period constraint. Additionally, it eliminates the need for a physical model of the plant. Closed-loop identification of the nuclear system is carried out based only on external reactivity and neutron power by a differential neural network. This network utilizes a new learning law by which it is possible to guarantee the boundedness for weights and identification error. Once a neural model of the reactor is obtained, inverse period constraint can be expressed as a new constraint on the control input (external reactivity). However, an error term must be calculated to determine the new admissible set of control signal. This difficulty is overcome by using the sliding mode technique. Finally, a new control law is proposed. The effectiveness of this procedure is illustrated by numeric simulation.*
Keywords: Differential neural network, Constrained control, Nuclear research reactor

1. **Introduction.** The TRIGA Mark III nuclear reactor of the National Nuclear Research Institute (ININ) of Mexico must be controlled in such a way that the inverse period constraint is always satisfied. If this constraint is not respected, a scram (automatic shut down of the reactor) is immediately activated. Currently, in order to avoid this problem, the ININ reactor uses a PID-type scheme whose control action is properly limited. It is possible to carry out the main activities of the reactor with this control scheme. However, system performance can still be improved. In order to extend the range of possible applications of the ININ reactor, power profile tracking capability, which is not currently available on site, must be implemented. In general, the tracking problem is a main concern for control community due to its practical implications. This problem has been studied from several perspectives: sliding modes, neural networks, adaptive control,