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MULTI-OBJECTIVE OPTIMIZATION OF A STACKED NEURAL NETWORK USED IN MODELING OF AN ELECTROLYSIS PROCESS

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Abstract

This study presents the results obtained from the development of an optimized stacked neural network and its application in modeling of an electrolysis process with the anodic oxidation of different organic compounds, using boron doped diamond as anode and different types of cathodes. The development of an optimized stacked neural network was performed through a hybrid evolutionary algorithm which combined the NSGA-II (Non-dominated Sorting Genetic Algorithm – II) with the Quasi-Newton local search algorithm. The multi-objective optimization method provided an optimal Pareto set of non-dominated solutions representing equally good compromises between the two objectives pursued: the maximization of the generalization capacity of the stacked neural network and the minimization of its structural complexity. Achieving the two conflictual objectives meant determining the optimum value for the number of neural networks in the stack, the optimum amount of hidden neurons in each individual network from the stack, and the best weights assigned to every output of the networks composing it. The hybrid evolutionary algorithm proved to be a very suitable and easy to use tool in developing an optimized stacked neural network. The three stacked neural networks selected from the optimal Pareto front showed a great performance in modeling the electrolysis process with a correlation in the validation phase of 0.99.

Key words: electrolysis, evolutionary algorithm, multi-objective optimization, organic compound, stacked neural network

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