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# Artificial Neural Network-Cuckoo Optimization Algorithm (ANN-COA) for Optimal Control of Khorramabad Wastewater Treatment Plant, Iran

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**Abstract**

In this study a hybrid estimation model ANN-COA developed to provide an accurate prediction of a Wastewater Treatment Plant (WWTP). An effective strategy for detection of some output parameters tested on a hardware setup in WWTP. This model is designed utilizing Artificial Neural Network (ANN) and Cuckoo Optimization Algorithm (COA) to improve model performances; which is trained by a historical set of data collected during a 6 months operation. ANN-COA based on the difference between the measured and simulated values, allowed a quick revealing of the faults. The method could obtain the fault detection and used in solving continuous and discrete optimization problems, successfully. After constructing and modelling the method, selected performance indices including coefficient of Regression, Mean-Square Error, Root-Mean-Square Error and Aggregated Measure used to compare the obtained results. This analysis revealed that the hybrid ANN-COA model offers a higher degree of accuracy for predicting and control the WWTP.

*Keywords:* Wastewater Treatment Plant; Artificial Neural Networks; Cuckoo Optimization Algorithm; Prediction Analysis; Reliability.

## 1. Introduction

Municipal and Industrial wastewaters are accounting for several types of contaminators released into the aquatic environment. Improper operation of a Wastewater Treatment Plant (WWTP) may bring rising concern about environment and public health problems [1].

The developments of a control system for the WWTPs are important to maintain high performance and to keep the process stable [2-4]. In the last two decades, there has been constantly increasing interest in Artificial Neural Networks (ANNs) as a reliable model for efficient monitoring, predicting performance and controlling the operation and variables of the process in the complicated nonlinear and multivariable processes such as chemical engineering process, bioprocess and wastewater treatment process [5-8]. For any WWTP, the reliable ANN technique is essential in order to avoid process failure [9]. To this end, ANNs have been developed to predict WWTP performance with a higher degree of accuracy and solve complex engineering problems more rapidly [10].

ANNs comprise interconnected group of nodes (artificial neuron) with weighted connections (synaptic weights) from the output of one neuron to the input of another to estimate or approximate functions that can depend on a large number of inputs [11-14]. However, ANN is used in many areas of environmental science as a promising tool because

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