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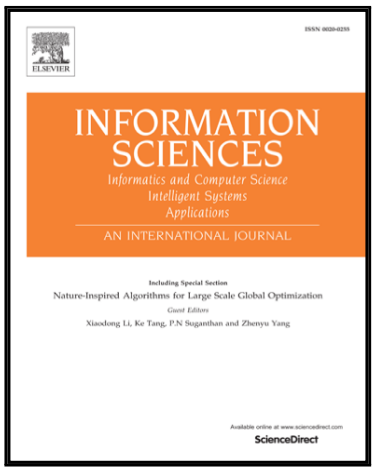


# Tracking Control of Nonaffine Systems Using Bio-inspired Networks with Auto-Tuning Activation Functions and Self-Growing Neurons

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# Tracking Control of Nonaffine Systems Using Bio-inspired Networks with Auto-Tuning Activation Functions and Self-Growing Neurons

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**Abstract**

This paper presents a bio-inspired artificial neural network (Bio-ANN) to tackle the tracking control of complex dynamic systems. The proposed Bio-ANN is motivated by the operant conditioning of biological systems, in which we not only adaptively tune the weights but also adjust the structural parameter of basis functions automatically, significantly enhancing the learning capability of the proposed control. Furthermore, the size of the dataset needed for online ANN training is small and the overall computational cost is low. With the help of such Bio-ANN, we develop a control scheme for a class of single-input single-output non-affine systems, where the operant conditioning bionic model (OCBM) is utilized. By comparing the proposed method with existing self-organizing approaches via numerical simulations, we verify that a faster convergent rate is achieved with better control precision by using the proposed OCBM based control approach.

***Keywords**:* Bio-ANN, Adaptive weights, Lyapunov stability, Non-affine system, Operant conditioning bionic model (OCBM)

## 1. Introduction

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