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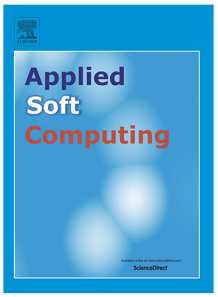

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Solving Transcendental Equation Using Artificial Neural Network

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Abstract

Transcendental equations play important role in solving various science and engineering problems. There exist many transcendental equations, which may not be solved by usual numerical methods. Accordingly, this paper gives a novel idea for solving transcendental equations using the concept of Artificial Neural Network (ANN). Multilayer Network architecture (viz. Four-layer network architecture) has been proposed for solving the transcendental equation. The detail network architecture with the procedures to solve single and system of transcendental equations have been discussed. The weights from input layer to the first hidden layer consist of the unknown variable and other weights in different layers are the known coefficients with respect to the given transcendental equation. After training by proposed steps and back propagation technique starting with a guess value(s) the unknown variable(s) tend to converge depending upon the accuracy thereby giving the solution of the equation. Few standard example problems have been presented to validate the proposed method. Further, two examples have been included to show the applicability of the ANN method in comparison to the well-known numerical method. Moreover, an application problem of junction diode circuit has also been addressed.

Keywords: Transcendental equation, Artificial Neural Network (ANN), Junction diode circuit.

1. Introduction

Various methods are known till date to solve the transcendental equation, but this paper describes a novel method to solve transcendental equations based on the concept of Artificial Neural Network (ANN). Step by step procedures for the proposed ANN method have been addressed. The transcendental equations have many applications in different areas of science and engineering for example cantilever beam, finding the solution of junction diode circuits, power electronics modelling etc.

A method to find all solutions of the systems of nonlinear equation with free variables has been proposed by Tsai and Lin [1]. Using the subdivision algorithm, Smiley and Chun [2] found all the solutions of a nonlinear system. Margaris and Goulianas [3] have found all the roots of 2×2 algebraic equation using the concept of artificial neural network. A linear programming based method to find all the solutions of a nonlinear system of equations has been discussed by Nakaya and Oishi [4]. Mishra and Kalra [5] presented a neural network based approach to find the solution of a set of nonlinear equations. An evolutionary algorithm based approach has been studied to solve nonlinear equation systems by Grosan and Abraham [6]. Mathia and Saeks [7] used the concept of recurrent neural networks to solve the nonlinear equations. Using the critical point theory and Lusternik-Schnirelmann category theory, Zhang and Bai [8] discussed both the existence of nonzero solution pairs and the nonexistence of nontrivial solutions for a nonlinear

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