Neural Algorithm for Solving Differential Equations

HYUK LEE

Department of Electrical Engineering, Polytechnic Institute of New York,
Brooklyn, New York 11201

AND

IN SEOK KANG

Department of Chemical Engineering, California Institute of Technology,
Pasadena, California 91125

Finite difference equations are considered to solve differential equations numerically by utilizing minimization algorithms. Neural minimization algorithms for solving the finite difference equations are presented. Results of numerical simulation are described to demonstrate the method. Methods of implementing the algorithms are discussed. General features of the neural algorithms are discussed.   © 1990 Academic Press, Inc.

I. INTRODUCTION

Numerical computation in many disciplines, such as physics, applied mathematics, electrical engineering, biochemistry, etc., has received a great deal of attention recently as a practical technique to understand complex phenomena that are almost impossible to treat analytically [1]. Supercomputers have been built to speed up the calculation. Furthermore, new computing algorithms based on the concept of concurrent processing have been developed and implemented by connecting a small number of processors.

Recently, highly parallel neural networks have been investigated extensively to solve complicated problems such as pattern recognition and combinatorial optimization [2]. Linear simultaneous equations also have been treated by applying neural networks [3]. Implementation of neural networks by utilizing volume holographic optical interconnections have proved to be promising [4].

One of the most general methods of solving differential equations is to use finite difference equations and to solve the algebraic equations [5]. The computational load for solving the difference equations increases very fast as the number of discrete points becomes large. Therefore, a highly parallel algorithm to solve the finite difference equations is essential when a complicated problem is encountered. In this paper, neural algorithms for minimization are utilized to develop highly parallel

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