

Preconditioning cubic collocation method for elliptic equations

Sang Hun LEE and Byeong Chun SHIN

(Received June 17, 1996)

Abstract. In this paper we provide the preconditioning results of the linear system generated by the cubic spline collocation discretization with penalty terms for an elliptic equation with Neumann boundary conditions. Moreover, we show that the linear system of an elliptic equation with Dirichlet or mixed boundary conditions can be directly derived from the linear system of the same equation with Neumann boundary conditions.

Key words: C^1 -cubic spline, preconditioning collocation method.

1. Introduction

In this paper, we will provide preconditioning results of the cubic spline collocation discretization with penalty terms for a positive definite second order elliptic boundary value problem with Neumann boundary conditions.

In the course of patching collocation method introduced by Orszag in [O] for elliptic boundary value problems, Funaro has provided a method to handle different types of boundary conditions in [F2]. The idea is to collocate an equation at both the interior nodes and the boundary nodes of a given interval for the equations to be solved at the boundary points. In this paper, we will deal with the preconditioning cubic spline collocation method for the Neumann problem following the ideas provided in [F2] and [KP].

Let us consider an equation

$$-u'' + cu = f \quad \text{in } (0, 1) \tag{1.1}$$

with the Neumann boundary conditions

$$u'(0) = 0, \quad u'(1) = 0, \tag{1.2}$$

1991 Mathematics Subject Classification : 65N30, 65N35.

This paper was supported by Korean Ministry of Education through Research Fund (BSRI-96-1401) and TGRC-KOSEF.