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A NONCONFORMING FINITE ELEMENT METHOD OF UPSTREAM TYPE APPLIED TO THE STATIONARY NAVIER-STOKES EQUATION (*)

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Abstract. — *We present a nonconforming finite element method with an upstream discretization of the convective term for solving the stationary Navier-Stokes equations. The existence of at least one solution of the discrete problem and the convergence of subsequences of such solutions to a solution of the Navier-Stokes equations are established In addition, under certain assumptions on the data, uniqueness of the solution can be guarenteed and error estimates of the approximate solution are given Moreover, some favourable properties of the discrete algebraic system are discussed*

Resumé — *Nous présentons une méthode non conforme d'éléments finis avec une discrétisation décentrée amont du terme de convection pour la résolution des équations de Navier-Stokes stationnaires On prouve l'existence d'une solution au moins du problème discret et la convergence des sous-suites de telles solutions vers une solution des équations de Navier-Stokes stationnaires En outre on peut sous certaines hypothèses sur les données garantir l'unicité et on donne alors des estimations d'erreur de la solution approximative En outre on discute quelques propriétés importantes du système algébrique discret*

1. INTRODUCTION

The Navier-Stokes equations for viscous, incompressible flow problems have been the object of considerable research efforts. Because of its great flexibility finite element methods have received considerable attention, both from a theoretical and computational point of view. In general one uses finite elements of higher-order shape functions in order to get better approximations of velocity and pressure fields. However, this can be guaranteed, at least theoretically, only for sufficiently smooth solutions of

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