International Journal of Innovative Computing, Information and Control
Volume **7**, Number **2**, February **2011**

ICIC International ©2011 ISSN 1349-4198
pp. 817–825

INEXACT NEWTON METHOD TO SOLVE NONLINEAR IMPLICIT COMPLEMENTARITY PROBLEMS

Nataliya I. Kalashnykova[1,4], Vyacheslav V. Kalashnikov[1,2,3]
and Aarón Arévalo Franco[4]

[1]Sumy State University
Rimsky-Korsakov str. 2, Sumy 44007, Ukraine
kalash@itesm.mx; natanl@mail.ru

[2]Department of Systems Engineering
ITESM, Monterrey, Nuevo León, Mexico

[3]Central Economics and Mathematics Institute (CEMI)
Russian Academy of Sciences (RAS)
Nakhimovsky pr. 17, Moscow 117418, Russia

[4]Department of Physics and Mathematics
Universidad Autónoma de Nuevo León
San Nicolás de los Garza, Nuevo León, Mexico
aaronare@yahoo.com

Received October 2009; revised February 2010

Abstract. *In this work, we present a numerical method to solve the Implicit Complementarity Problem. After having established estimates for the measure of error, we apply an inexact Newton algorithm to the Implicit Nonlinear Complementarity Problem. Next, we deduce sufficient conditions for existence and uniqueness of the solution and show the convergence of the approximate solutions of auxiliar linear implicit complementarity problems to the desired solution of the original nonlinear implicit complementarity problem. Finally, the convergence rate is also estimated.*

Keywords: Implicit complementarity problems, Inexact Newton method

1. **Introduction.** The Complementarity Theory is a relatively new area of Applied Mathematics, which has been rapidly developing and expanding during the recent decades. It is related to mathematical modelling, optimization theory, engineering, structural mechanics, elasticity, lubrication theory, economics, variational calculus, equilibrium theory, stochastic optimal control, etc.

The Complementarity Theory has been generalized and extended in many different directions. The implicit complementarity problem (ICP), which is one of such generalizations of the standard complementarity problem, was raised to life by some special problems in stochastic optimal control [1-3].

The finite-dimensional implicit complementarity problem (ICP) can be introduced as follows: Find an $x \in R^n$ such that:

$$f(x) \geq 0, \quad g(x) \geq 0 \quad \text{and} \quad [g(x)]^T f(x) = 0,$$

where $f, g : R^n \to R^n$ are continuous mappings, and the inequalities are component-wise.

The ICP has been studied in a plenty of works, *cf.* [4-17]. Recently, a new method has been proposed to study the solvability of complementarity problems. This method is based upon the concept of an exceptional family of elements (EFE) for a continuous mapping. The notion of EFE was introduced in order to use the topological degree theory