



Recent applications and numerical implementation of quasi-Newton methods for solving nonlinear systems of equations

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Received 17 December 2001; accepted 20 November 2002

This paper presents a survey on recent applications of quasi-Newton methods to solve nonlinear systems of equations which appear in applied areas such as physics, biology, engineering, geophysics, chemistry and industry. It is also presented a comparative analysis of the performance of the ICUM (Inverse Column-Updating Method) and Broyden's method when applied to some of the problems mentioned above.

Keywords: nonlinear systems, quasi-Newton methods, Broyden's method, inverse column-updating method

AMS subject classification: 65H10

1. Introduction

In recent years, quasi-Newton methods for solving square smooth nonlinear systems have been out of the mainstream of numerical analysis research [11]. Sometimes, research in a family of numerical techniques becomes out-of-fashion after its incorporation to the toolbox of problem solvers in physics, chemistry, engineering and industry. So, promising algorithms are completely forgotten, both in research and in applications.

The motivation for this work was to try to answer some questions about quasi-Newton methods such as: (i) are there problems, in recent applied research, for which the quasi-Newton methods are the best option? (ii) which are they? (iii) why? These questions led us to make a rigorous bibliographical research. Among 295 applications that use quasi-Newton methods, we selected ten that we found more interesting, covering several applied areas such as physics, engineering, biology, astrophysics, etc. [15]. Almost all of them used, as a tool to solve the nonlinear system that appeared in their