THE METHOD OF LINES - THEORY, SOFTWARE AND SOME APPLICATIONS

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In a recent review of software for the numerical solution of partial differential equations (PDEs), Machura & Sweet [11] assert that the method of lines (MOL) is the most popular technique for solving systems of time-dependent PDEs. The MOL is a direct and practical consequence of extensive research on the numerical solution of ordinary diffential equations. A number of robust and user-friendly software interfaces are now available to implement the method, and this note describes the application of one such interface (PDEONE, Sincovec & Madsen, [15]) to three consulting problems. The results confirm that the MOL is a valuable consequence of past mathematical development.

1. INTRODUCTION

The numerical solution of partial differential equations (PDEs) is a bread-and-butter issue in applied mathematics and most branches of the physical and engineering sciences. Many of the PDEs which require a numerical solution are (possibly systems of) parabolic PDEs for which the method of lines (MOL) is ideally suited. The MOL is based on semi-discretization: the conversion of PDEs into a set of ordinary differential equations (ODEs). There are many ways available for this, and the utility of all the methods derives from highly developed and robust software for the numerical solution of ODEs. Thus the MOL - a widely used and obviously practical