and the computation time are given in each table.

When the initial value of $x_2(t_f)$ was held at 0.70 and ten initial values of $x_1(t_f)$ were taken from 0.15 to 0.06, the BCI method of Denn and Aris required 0.61 min. of computation time to reach $e < 0.001$ and 1.09 min. to reach $e < 0.0001$. With the BCI method of Jaspan and Coull, only 5 cases were run corresponding to $x_1(t_f) = 0.15, 0.14, 0.13, 0.12$, and 0.11. The computation times were 2.67 min. to obtain $e < 0.001$ and 3.89 min to obtain $e < 0.0001$. For the initial value of $x_1(t_f) = 0.11$ and $x_2(t_f) = 0.70$, convergence, however, was not obtained within 1000 iterations.

In Tables 3 and 4 the computational results of the CVI method based on the method of Rao and Luus (1972) are given. Also, Horn's method as proposed by Jaspan and Coull (1971) was run for comparison. As can be seen, the CVI method is considerably faster. It should be noted also that for the CVI method isothermal initial trajectories were used

$$u^{(0)}(t) = K \quad 0 \leq t < 10 \qquad (3)$$

whereas for Horn's method

$$u^{(0)}(0) = K \qquad (4)$$

so that the CVI method is placed at a disadvantage.

A modification is proposed for the Horn's method. Instead of using $\epsilon = 0.05$ initially, it is proposed to use $\epsilon = 1.0$ and then to halve ϵ whenever overstepping occurs. This modification greatly improves the method to make it comparable to CVI method for convergence to $x_2(t_f) > 0.6792$ and better for convergence to $x_2(t_f) > 0.6800$.

It is, however, important to note that even with the presently proposed modification to Horn's method, the CVI method is still faster with the choice of $K = 340$ and $x_2(t_f) > 0.6800$. This refutes the statement of Jaspan and Coull (1974) that Horn's method must be the fastest method in unconstrained problems.

The letter of Tsang and Luus (1972) and the present letter have not been intended to appraise the work of Jaspan and Coull but to defend the position of CVI methods in the face of unjustified claims of Jaspan and Coull. Although Tables 1 to 4 do not give a complete picture, it is nevertheless clear that we should not be too hasty in dispatching the CVI methods.

The tables also show that the claim of Tsang and Luus (1972) that the CVI method is superior to the BCI, GBCI, and Horn's method (as formulated by Jaspan and Coull) for this particular example is not rash at all. In fact, the CVI method is about 10 times faster than the BCI method and about 3 times faster than the latter method, not to mention the extra effort required for the procedures of Jaspan and Coull to obtain the initial values for ϵ and the initial range for $x_1(t_f)$ and $x_2(t_f)$ to ensure stability. It should also be noted that Horn's method is not a boundary condition iteration method.

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BOOKS *(continued from page 1037)*

The book is illustrated with good line drawings and with photographs. A few of the photographs are not of the first quality. Bibliographic listings are somewhat skimpy, possibly because the author leaned heavily on instrument manufacturer's literature for much of his basic information. A convenient summary of all the on-line analyzers described in the book is presented in a table preceding the index. The table contains these items: (1) manufacture, (2) quantitative capability, (3) power supply requirements, (4) physical dimensions, (5) weight, and (6) electrical safety classification. A list of the addresses of selected instrument manufacturers in the United States, the United Kingdom, and Europe is also included.

Any reader familiar with a particular kind of analyzer will doubtlessly find some gaps in the coverage provided by Clevett. This is inevitable in a field which is developing at so fast a rate. Nonetheless, this book is the best presentation of the current state of the art on instruments for process stream analysis.

The readership to which this work is directed includes practicing chemical engineers involved in plant design or operation, laboratory analysts, and instrument engineers in almost any field of food, chemical, or petroleum manufacture. Advanced undergraduates or professional engineers in these fields will find this handbook a valuable source of information.

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New Developments in Gas Chromatography, Howard Purnell, (Ed.), John Wiley, New York (1973). 408 pages. $9.95.

This book is Vol. 11 in the *Advances in Analytical Chemistry and Instrumentation* series edited by C. N. Reilley and R. W. Murray and contains seven articles describing developments in the forensic applications of gas chromatography, applications of digital computers to GC; applications of gas chromatography to production-scale separations, and GC studies of reaction kinetics, solvent phase changes, chemical complex formation, and the structure of polymers.

The articles are well written and noteworthy in that, unlike too many other *Advances* compendia, the articles have sufficient breadth and background to make their material accessible to research workers who are not specialists in each field. In addition, the articles present overviews of fields of application rather than a catalog of the contents of the long bibliographies that are an essential part of this type of book.

The review of chemical reactor applications of GC is particularly timely, as is the section on forensic applications of GC. The section on production scale gas chromatography presents suggested criteria for choosing GC over more conventional industrial separation techniques but lacks any discussion of gas chromatography processes such as hypersorption, and others which have reached commercial scale. The article also fails to note that a major commercial source of production-scale GC columns, referred to frequently, is no longer available.

The book is recommended strongly as a useful reference.

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