

PACKAGE ID - 000216IBMPC00 LSOE

KWIC TITLE - Ordinary Differential Equation System Solver

AUTHORS - Hindmarsh, A.C.
Lawrence Livermore National Lab., CA (United States)

LIMITATION CODE -UNL **AUDIENCE CODE** - UNL

COMPLETION DATE - 09/01/1986 **PUBLICATION DATE** - 12/30/1986

DESCRIPTION - LSOE is a package of subroutines for the numerical solution of the initial value problem for systems of first order ordinary differential equations. The package is suitable for either stiff or nonstiff systems. For stiff systems the Jacobian matrix may be treated in either full or banded form. LSOE can also be used when the Jacobian can be approximated by a band matrix.

PACKAGE CONTENTS - Media Directory; Software Abstract; Installation Instructions; CMRD Reports, Solving Ordinary Differential Equations on an IBM PC Using LSOE (9 pages); Media Includes Source Code, Sample Problem Input and Output, Machine Readable Documentation;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 5.25 Diskette

METHOD OF SOLUTION - LSOE contains two variable-order, variable-step (with interpolatory step-changing) integration methods. The first is the implicit Adams or nonstiff method, of orders one through twelve. The second is the backward differentiation or stiff method (or BDF method, or Gear's method), of orders one through five.

COMPUTER - IBM PC

OPERATING SYSTEMS - DOS 2.10; DOS 3.10

PROGRAMMING LANGUAGES - FORTRAN 77

SOFTWARE LIMITATIONS - The differential equations must be given in explicit form, i.e., $dy/dt = f(y,t)$. Problems with intermittent high-speed transients may cause inefficient or unstable performance.

SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - LSOE offers a great deal of flexibility as to choice of basic method, either stiff or nonstiff, nonlinear corrector iteration method - 6 choices, error tolerances including component wise relative and absolute tolerances, stopping criterion - at a specified time, t , or after every step, possibly with a critical t , optional input controls, e.g. maximum order or print flags, optional output controls, e.g. step and function evaluation counts

PACKAGE ID - 000216IBMPC00 LSOODE

UNIQUE FEATURES - (CONT) and derivatives of the solution, interrupt and restart capabilities, etc. Work space arrays and the names of the user-supplied routines are passed as subroutine arguments for flexibility. User-controlled dynamic work space, real and integer, can also be passed to the user routines.

RELATED SOFTWARE - LSOODE supersedes both GEAR and GEARB. For problems with intermittent high-speed transients, see VODE for case of a full Jacobian or of a banded Jacobian. LSOODE uses routines from LINPACK and several of the Basic Linear Algebra Subprograms (BLAS) to solve linear algebraic systems. LSOODE is also included in ODEPACK, a systematized collection of ODE solvers.

OTHER PROG/OPER SYS INFO - The FORTRAN source of LSOODE is heavily commented to facilitate modification. The IBM PC MSF3.20 version does not have the standard LSOODE interrupt/restart capability. The IBM PC version contains two releases: MSF3.20, developed and tested under MS FORTRAN 3.20, which also runs under MS FORTRAN 3.30 and 3.31, and MSF3.31, developed and tested under MS FORTRAN 3.31, which fails under MS FORTRAN 3.20 and 3.30. NESC executed both releases successfully under IBM Professional FORTRAN after removing the two Microsoft metacommands, \$NOFLOATCALLS and \$STORAGE: 2, at the beginning of each source file.

HARDWARE REQS - The IBM PC version assumes the presence of the 8087 or 80287 math coprocessor chip. Storage requirements are highly problem-dependent. The sample problem required 91 Kbytes of memory on an IBM PC/AT.

TIME REQUIREMENTS - NESC executed the sample problem in 10 minutes on an IBM PC and 4 minutes on an IBM PC/AT.

REFERENCES - A.C. Hindmarsh, Instructions for Installing LSOODE, LLNL Memorandum M-4162, May 1983; A.C. Hindmarsh, CMRD Reports, Solving Ordinary Differential Equations on an IBM PC Using LSOODE\ Alan C. Hindmarsh, Solving Ordinary Differential Equations on an IBM PC Using LSOODE, LLNL Tentacle, Volume VI, Number 4, pp. 10-18, April 1986; Alan C. Hindmarsh, The ODE Solver LSOODE on a PC--Followup, LLNL Tentacle, Volume VI, Number 6, pp. 4-7, June 1986; G. D. Byrne and A. C. Hindmarsh, An Annotated List of Some Codes for Solving $dy/dt = f(y,t)$, $y(t_0) = y_0$, National Energy Software Center Note 81-71, August 13, 1981; A. C. Hindmarsh, Linear Multistep Methods for Ordinary Differential Equations: Method Formulations, Stability, and the Methods of Nordsieck and Gear, UCRL-51186, March 1972; C. W. Gear, Numerical Initial Value Problems in Ordinary Differential Equations, Prentice-Hall, 1971.

ABSTRACT STATUS - Abstract first distributed December 1973. IBM PC version submitted September 1986, sample problems executed by NESC September 1986 on an IBM PC/AT.

SUBJECT CLASS CODE - P

PACKAGE ID - 000216IBMPC00 LSOE

KEYWORDS -

COMPUTER PROGRAM DOCUMENTATION
L CODES
DIFFERENTIAL EQUATIONS
BOUNDARY-VALUE PROBLEMS
NUMERICAL SOLUTION

EDB SUBJECT CATEGORIES -

990200

SPONSOR - DOE/ER

PACKAGE TYPE - TESTED