PACKAGE ID - 000416I037000 EGUN

KWIC TITLE - Calculation of Electron Trajectories

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

COMPLETION DATE - 06/01/1982 **PUBLICATION DATE -** 06/01/1982

DESCRIPTION - EGUN, the SLAC Electron Trajectory Program, computes trajectories of charged particles in electrostatic and magnetostatic focusing systems including the effects of space charge and self-magnetic fields. Starting options include Child's Law conditions on cathodes of various shapes, user-specified initial conditions for each ray, and a combination of Child's Law conditions and user specifications. Either rectangular or cylindrically symmetric geometry may be used. Magnetic fields may be specified using arbitrary configuration of coils, or the output of a magnet program, such as Poisson, or by an externally calculated array of the axial fields.

PACKAGE CONTENTS - Media Directory; Software Abstract; SLAC-226; Media Includes Source, Sample Problem, Control Information;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - The program first solves Laplace's equation. Next, the first iteration of electron trajectories is started using one of the four starting options. On the first iteration cycle, space charge forces are calculated from the assumption of paraxial flow. As the rays are traced, space charge is computed and stored. After all the electron trajectories have been calculated, the program begins the second cycle by solving the Poisson equation with the space charge from the first iteration. Subsequent iteration cycles follow this pattern. The Poisson equation is solved by an alternate column relaxation technique known as the semi-iterative Chebyshev method. A fourth-order Runge-Kutta method is used to solve the relativistic differential equations of the trajectory calculations.

COMPUTER - IBM370

OPERATING SYSTEMS - OS/MVS; OS/SVS; VM

PROGRAMMING LANGUAGES - FORTRAN IV (99%) and Assembler (1%)

SOFTWARE LIMITATIONS - Maxima of 9001 mesh points in a square mesh, 300 mesh points in the axial direction, 100 mesh points in the radial direction, 101 potentials, and 51 rays. In cylindrical coordinates, the magnetic fields are axially symmetric. In rectangular

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SOFTWARE LIMITATIONS -(CONT) coordinates, any orientation of a two-dimensional magnetic field is possible.

SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - EGUN has special options for round beams in rectangular coordinates, heavy ion beams, image tubes, shadow grids, and dielectrics.

RELATED SOFTWARE - An auxiliary plotting program is included with the package. EGUN supersedes the programs described in SLAC-51 and SLAC-166.

OTHER PROG/OPER SYS INFO - EGUN uses the SLAC system routine, LEFT1, to determine the amount of CPU time remaining for job execution. This was not supplied. Use of LEFT1 is a nonessential option installed at the user's convenience in certain environments. NESC substituted a dummy subroutine LEFT1 and function ICLOCK for testing. Function ICLOCK is a Basic Assembly Language routine which calculates the elapsed CPU time. The sample plotting program included in the package uses the proprietary CalComp graphics library. Users will have to supply alternative timing and plotting routines suited to the local computing environment. Prospective new users of the program may contact the author to determine whether EGUN is appropriate for their intended applications.

HARDWARE REQS - 450K bytes of memory and two direct-access devices (logical units 1 and 8) are required.

TIME REQUIREMENTS - Running times vary greatly with the problem and the computer. A typical problem runs on an IBM370/168 in from 0.5 to 2 minutes of CPU time. NESC executed the sample problem in 12 CPU seconds on an IBM3033.

REFERENCES - William B. Herrmannsfeldt, Electron Trajectory Program, SLAC-226, November 1979; EGUN, NESC No. 983.370, EGUN Tape Description, National Energy Software Center Note 82-53, June 30, 1982\ W.B. Herrmannsfeldt, Numerical Design of Electron Guns and Space Charge Limited Transport Systems, SLAC-PUB-2631, October 1980; Wm.B. Herrmannsfeldt, Poisson Equation Solving Program, SLAC-51, September 1965; William B. Herrmannsfeldt, Electron Trajectory Program, SLAC-166, September 1973.

ABSTRACT STATUS - Abstract first distributed June 1982. IBM370 version submitted January 1982, sample problem executed by NESC June 1982 on an IBM3033 and IBM370/195.

SUBJECT CLASS CODE - V

KEYWORDS -
COMPUTER PROGRAM DOCUMENTATION

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E CODES
TRAJECTORIES
BEAM DYNAMICS
ELECTRON BEAMS
ELECTRON GUNS
ACCELERATORS
BEAM TRANSPORT
DIRICHLET PROBLEM
FINITE DIFFERENCE METHOD
ION BEAMS
KLYSTRONS
LAPLACE EQUATION
PHASE SPACE
POISSON EQUATION

EDB SUBJECT CATEGORIES -
990200 430200

SPONSOR - DOE/ER

PACKAGE TYPE - TESTED