IDENTIFICATION

EQUATIONS OF MOTION SUBROUTINE - EQUAM
704 FORTRAN Program
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PURPOSE

This subroutine, suggested by G. Parzen, solves the equations

(1) $\dfrac{dx}{d\theta} = (A + x) \dfrac{p_x}{\sqrt{1 - p_x^2 - p_y^2}}$

(2) $\dfrac{dp_x}{d\theta} = \sqrt{1 - p_x^2 - p_y^2} - \lambda (A + x) \left[H_y - \dfrac{p_y H_\theta}{\sqrt{1 - p_x^2 - p_y^2}} \right]$

(3) $\dfrac{d\boxminus}{d\theta} = \dfrac{N}{2\pi}$

(4) $\dfrac{dy}{d\theta} = (A + x) \dfrac{p_y}{\sqrt{1 - p_x^2 - p_y^2}}$

(5) $\dfrac{dpy}{d\theta} = (A + x) \lambda \left[H_x - \dfrac{p_x H_\theta}{\sqrt{1 - p_x^2 - p_y^2}} \right]$

in floating point arithmetic, and prints the values of x, p_x, y, p_y, $N\theta/2\pi$ at requested intervals.

RESTRICTIONS

The SHARE II printer board is used. This subroutine is intended to be used only in conjunction with programs written in the FORTRAN language.

USAGE

EQUAM is available on the FORTRAN system tape at this installation and it is executed by means of the main program statement

CALL EQUAM (X, PX, Y, PY, THP, A, FLAM, FNRK, XMAX, PXMAX, YMAX, PYMAX, MEQ, N, NE, NPZ, NP)

The entry values of x, p_x, y, p_y, and $\boxminus$ are found at locations X, PX, Y, PY, and THP respectively. Control is returned to the main program with the latest calculated values of these variables at these locations.

A and λ are found at A and FLAM respectively. They are not destroyed by EQUAM.

FNRK is the number of integration steps in $2\pi/N$. EQUAM uses it to calculate the integration step size

$$h = \frac{2\pi/N}{FNRK}$$

The maximum values to be allowed for $|x|$, $|p_x|$, $|y|$, and $|p_y|$ are found at XMAX, PXMAX, YMAX, and PYMAX respectively.

MEQ denotes the degrees of freedom in the calculations. MEQ = 1 denotes one dimensional integration and causes EQUAM to use only equations (1), (2), and (3). MEQ = 2 denotes two dimensional integration for which all five equations are used.

NE is the number of integration steps to be taken before control is returned to the main program.

NPZ and NP denote the times for printing x, p_x, y, p_y, and $N\theta/2\pi$. The first print occurs after the NPZ[th] integration step. If NPZ = 0, an initial print is made before integration. Successive prints are made after every NP[th] step. If NP = 1, printing occurs after each step. If NP = 2, it occurs every other step, etc. If NP = 0, EQUAM acts as if NP = 1.

ASSEMBLY PUNCH-OUT

When assembling a program that uses EQUAM, 8 subroutines are punched from the FORTRAN tape in addition to EQUAM itself. They are: EQUAMA, EQUAMB, SQRT, (BDC), (FIL), (SPH), (LEV), and (RTN).

METHOD

Integration is done by the modified GILL process of MURKY5.

AUXILIARY SUBROUTINE

The user must supply an auxiliary subroutine to provide the values of H_x, H_θ, and H_y for EQUAM. It must be written in the FORTRAN language, and have as its first statement

SUBROUTINE MAG (S, Y, THP, HX, HTH, HY)

where the values of x, y, θ' can be found at X, Y, THP, and must not be destroyed. The values of H_x, H_θ, H_y are to be stored at HX, HTH, HY respectively before execution of the statement

RETURN

VARIABLES

The variables X, PX, Y, PY, THP, A, FLAM, FNRK, XMAX, PXMAX, YMAX, PYMAX, HX, HTH, and HY are floating point numbers.

The variables MEQ, N, NE, NPZ, and NP are integers.

NEGATIVE INTEGRATION

Negative integration can be obtained by making FNRK negative.

PRINT FORMATS

The variables x, p_x, y, p_y, and $N\theta/2\pi$ are printed from left to right on one line.

If the absolute values of x, p_x, y, p_y exceed their respective allowable maxima, a sentence to that effect, plus the step number, is printed on one line, followed by the maximum and current values on two succeeding lines.

If the values of $(p_x^2 + p_y^2)$ equals or exceeds one, a sentence to that effect plus the step number is printed on one line, followed by a line of the current variables x, p_x, y, p_y, $N\theta/2\pi$.

CODING INFORMATION

The subroutines EQUAM, EQUAMA, and EQUAMB require 471, 165, and 224 words (decimal) in storage respectively.