NASA TECH BRIEF

Lewis Research Center

N-BODY U AND K MATRIX PROGRAM

The Problem:

A program was needed to compute the free-fall trajectories of satellites allowing for injection errors and midcourse velocity perturbations.

The Solution:

A main program and a system of subroutines designed to include all the necessary variables.

How It's Done:

Two-body equations of motion provide solutions to the problem of describing the motion of a small particle (space vehicle) near a large particle (celestial body). A two-body solution establishes a reference conic section or sections (circle, ellipse, parabola, or hyperbola) and describes the motion of a small particle along this reference path. However, a two-body representation is not sufficiently accurate when a precise description of orbits is required. In the case of earth-satellite motion, for example, the two-body representation neglects such effects as the earth's oblateness and the attractions of the sun, moon, and planets. These influences are known as perturbations and must be incorporated into the equations of motion when computing precision trajectories.

The U and K Program computes linear partial derivative matrices for mapping injection errors and midcourse velocity perturbations into lunar and interplanetary target miss parameters. The program consists of a trajectory perturbing program and an N-body integrating conic program which can also be used as a 2-body patch conic program. The N-body mode produces precise space trajectories; the 2-body does not. However, for the purpose of computing partial derivative mapping matrices, the 2-body mode closely approximates the results of the N-body mode.

Notes:

1. This program is written in FORTRAN IV for the CDC-6400 computer.
2. Inquiries concerning this program should be directed to:

   COSMIC
   Computer Center
   112 Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: LEW-11438

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