NASA TECH BRIEF
Goddard Space Flight Center

Geometric Field-Line Calculations

The problem:

To calculate the three components of the vector field from a spherical harmonic expansion using either geocentric or geodetic coordinates as input and output. The program also contains field-line tracing routines useful in several applications, for example: locating the position of conjugate points, determining mirror point locations for particles at a given position with a given pitch angle, etc.

The solution:

The three components of the vector field are returned as output in either geocentric or geodetic coordinates according to how they were entered, whereas the field-line tracing routine returns a line that passes through a point and is everywhere parallel to the location field direction as determined by the model.

How it's done:

The program is actually three subroutines, ALLMAG, GDALMG, and LINTRA. ALLMAG is a fundamental routine that calculates three components of the vector field from a spherical harmonic expansion. The relevant mathematical formulation is readily available in related

texts and is not included here. The coordinates entered into ALLMAG must be geocentric. If input must be geodetic, then the subroutine GDALMG must be called to convert the coordinates to the proper input parameters.

In the line-tracing, LINTRA, routine, the method used is to solve differential equations defining a field-line in order to obtain the correct values for field-line values.

Notes:

1. This program is written in FORTRAN IV for use on an IBM-360/(40, 75, and 91), IBM-7094, UNIVAC-1108, and CDC-6600.

2. Inquiries concerning this program should be directed to:

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