Computer Code Abstract

CYLMAP

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1. Program Identification: CYLMAP is a two-dimensional, cylindrical mesh mapping routine for computing intersection volumes and areas of overlaid grids.

2. Function: CYLMAP is a general purpose package that maps any arbitrary grid onto a rectangular mesh and computes intersection volumes and areas in cylindrical (r,z) geometry. Such mappings are of interest for coupled mesh computations. The intersection volumes and areas computed can be used to weight (smear) quantities such as cross sections, sources, fluxes, densities, masses, material properties energies, temperatures, etc., in transforming from one mesh to the other in transport, hydrodynamic, thermodynamic, and other related application areas.

3. Method of Solution: Exact expressions for the areas and volumes of rotation (about the z axis) are used. Intersection points of the two meshes are first computed and mapped onto corresponding regions on the rectangular mesh. Intersection points with the same regional indices are reordered into multilaterals, and the multilaterals are then triangulated for computation of intersection areas. Intersection volumes are obtained by rotating the intersection multilaterals about the z axis. The intersection regions are tagged with two indices, one from each parent mesh. Input consists of the lines defining the rectangular mesh and the coordinates of the arbitrary mesh, which are assumed to be joined by straight lines. Output consists of the intersection volumes and the indices tagging the appropriate intersecting cells of the two meshes. Execution diagnostics are generated at code crashes.

5. Restrictions: DIMENSION statements and COMMON blocks are controlled through PARAMETER specifications; thus CYLMAP is limited only by user core availability. Core storage requirements scale as the sum of the two mesh sizes. The rectangular mesh must completely enclose the arbitrary grid. The two routines ESECT and EMAP, which comprise CYLMAP, can also be interfaced with any user modules with information passed between simple COMMON blocks.

6. COMPUTER: Cray-1 or CDC 7600.

7. Running Time: Computations of intersection volumes generated by overlapping 10k rectangular and 2.2k radial meshes require 16 s of computer time on the CDC 7600, while computation times for the same meshes scaled by a factor of $\frac{1}{4}$ in number of grid points require 2 s. Run times on the Cray-1 are reduced by a factor of 3, roughly. The arbitrary meshes employed in the calculations are symmetrical, center-converging webs of 5- and 20-deg angular segments, respectively, with the largest number of cells near the center of convergence. The rectangular meshes are uniform. Generally, cases of small-cell rectangular meshes overlaid on large-cell arbitrary meshes require the longer running times.

8. Programming Languages: The CYLMAP code is written in FORTRAN-IV. Efforts were made to code in a machine- and installation-independent format.

9. Operating System: The Cray-1 version of CYLMAP operates under the CTSS system with CFT compiler. The CDC 7600 version runs under the LTSS operating system with FTN computer. The code is virtually exportable.

10. Machine Requirements: No special machine features are required. Mesh sizes are constrained by available core storage.

11. Material Available: Source code, test problems, results, and documentation[1] are available from the author.

12. Acknowledgment: This work was supported by the U.S. Department of Energy.

13. *References:*

[1] B. R. WIENKE and R. D. O'DELL, "ESECT/ELMAP: Mapping Algorithm for Computing Intersection Volumes of Overlaid Meshes in Cylindrical Geometry," LA-6627-MS, Los Alamos National Laboratory (1977).