Maple Maptools Technical Summary

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Introduction

This Maple package generates 2- and 3-dimensional maps of the earth based on functions supplied by the user that describing these projections. It was created as part of a senior level mathematics seminar at Villanova University.

This package (Maptools) is very similar to the "Maps" package submitted to MapleApps by Taylor, Baur, and Oprea, but Maptools was developed without knowledge of Maps' existence. Maptools may be a little slower to compute and involve more lines of programming code than Maps, but its use is much more straightforward for the inexperienced Maple user. Maptools contains error checks throughout its routines and supplies descriptive diagnostic messages to aid the user. Further, the Maptools plotting routines mimic existing Maple plot routines so that experienced Maple users can readily utilize them.

Package Summary

The purpose of this package was to make the map generation process easier. The two main requirements for these Maple routines were for them to accept an arbitrary projection and for them to show the projection of both the graticule (parallel and meridian gridlines) and the coastlines. Thus, at the most basic level, the user supplies

a mathematical description of a projection and the routines generate a plot of the projection within Maple.

Both 2- and 3-dimensional projections are supported. Every effort was taken to make the routines as "user-friendly" as possible so that a beginning Maple user could utilize them. However, numerous options have also been built-in to allow full customization of the routines by the advanced user.

Overview of Approach

In addition to accommodating both beginning and advanced users, the approach that was selected also made the implementation easier for the programmer to code. First, to simplify use for beginning users, the routines keep the actual data that represent the coastlines hidden from the user. Second, to make them straightforward for an advanced user to adjust to, the plot routines that were created intentionally mimic existing Maple plot routines. Finally, to make the programmer's job easier, existing Maple routines were utilized within the new routines that were created.

Four routines were created: two for database handling and two for plot generation. The two database functions are "load" (which loads a coastal point database from a file) and "extract" (which creates new, smaller databases from existing ones). The two plotting functions are "mapplot" and "mapplot3d", which generate 2-D and 3-D projections respectively.

In order to allow the user to avoid having to actually manipulate the coastline information, the user must "load" a database of coastal points to be used in subsequent plots that are created. What actually happens with a call to the "load" command is that a global variable called "coastal_points" (that is a list of [longitude, latitude] points) stored in the file is put into memory where it is accessed by the plot routines. The initial database file was created by writing custom Pascal code that converted a USGS database for geographical software into the form described above.

Each plot routine that was created consists of roughly 125 lines of Maple code. Nonetheless, their algorithm is fairly straightforward: process the user-specified options, create the graticule plot, create the coastline plot, and return an assembled plot. However, there are error checks throughout each of the routines that attempt to pinpoint problems in order to make them easy to use (which in turn makes the code very long).

For more information on each of the routines that were created, refer to their individual help pages (which completely describe the supported options and the required argument order, as well as include several examples). For a more practical (but less thorough) introduction to the routines, see the Quick Start Guide.