3D-XplorMath Description

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1   What is 3D-XplorMath?

1.1   Purposes and Goals

Perhaps the best short description of the program 3D-XplorMath is that it is a Virtual Mathematical Museum. Its primary purpose is to make it easy for users with little or no programming experience to visualize and interact with a variety of different kinds of mathematical objects.

The program started out life as a tool aimed at research mathematicians—to help them better understand mathematical objects they were investigating by supplementing the vague pictures they had in their heads by the more precise visualizations one can build on a computer screen. While that original purpose remains, the program has gradually added features that make it useful as a pedagogical tool, to enrich various mathematical curricula by adding a visualization component to what would otherwise be a purely textual explanation of complex mathematical concepts.

Finally the program is also aimed at all those who find mathematics beautiful and would like to develop a more intimate acquaintance with various remarkable mathematical objects by interacting with them through the magic of modern computer graphics.

1.2   Main Features of the Program

The program divides the world of mathematical objects into subsets—called Galleries in the Java version, 3D-XplorMath-J. (The original, Mac only, Pascal version uses the word Category, but we will stick with Gallery here.) The user can set the current Gallery from the Gallery menu, and once it is chosen there is a menu having the name of the current Gallery and containing a list of all of its Exhibits. As soon as the user selects an Exhibit from this so-called Main Menu, the program creates an image of a standard example of that Exhibit from data about it and certain default choices of parameters that are stored in the program. The user may then use various menus and dialogs to alter the parameters that describe the precise form of the Exhibit (e.g., for an ellipse, the major and minor axes), the viewpoint from which it is seen, and the method used to render it—e.g., if it is a surface whether or not to use stereo-vision, whether to display it in wireframe or in patch mode, and if in patch mode just how reflective the surface should be. Each of these

built-in Exhibits also has associated to it a so-called ATO file that provides documentation for the object, and this can be viewed while the program is running by selecting About This Object from the Documentation file. Extensive program documentation is also available via this menu.

The Galleries that are so far in the 3D-XplorMath museum include: Surfaces, Plane Curves, Space Curves, Conformal Maps, Polyhedra, Waves, ODEs, and Fractals and Chaos. In addition to the hundreds of built-in Exhibits that the program already knows about, a user can also create additional "user-defined" Exhibits in the various Galleries by entering formulas using standard mathematical notation. Both built-in and user-defined objects can depend on parameters, and the program can create morphing animations by moving along a path in the space of parameters.

Visualizations created by the program can be saved in jpeg and other graphic formats and the data defining 3D objects can be exported to other 3D programs such as Bryce or POV-Ray (in formats such as .obj and .inc), and similarly animations created by the program can then be saved as QuickTime movies.

As noted above, a Java-based, cross-platform version of the program is now available, however the earlier Macintosh only version written in Object Pascal is considerably more developed and has more Exhibits and features.