

# PREFABRICATED MATHEMATICAL FLASH MOVIE CLIPS

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Flash is a Web plugin developed by Macromedia that makes animations for the Web comparatively easy to create. The Web is now full of popup menus, twirling bears, and exploding text, thanks to Flash. The power of Flash is to make "movie clips" move, change size, and rotate without the pain of traditional programming in languages such as Java or Javascript. It is trivial to cause text to change colors, move on and off screen, to make buttons that are associated with actions, and in general to bring life to Web pages without detailed programming knowledge.

The power of Flash for animations gives it great potential for mathematical instructional materials. Indeed, a number of people have already generated extensive libraries of Flash movies to accompany textbooks, and have supervised workshops on the use of Flash in mathematics. These applications are typically specialized for a particular concept that is to be taught, or for an activity to accompany textual materials. Those who have ideas and needs for custom materials for their own courses must develop and program movies for themselves.

The problem for Flash is a comparative lack of precision in the high-level tools it provides. If the aim is to show balls travelling along curves or to animate other objects, this task is not difficult. If the curves must be very specifically parabolas then there is a problem. Paradoxically, standard mathematical tasks such as plotting functions and computing orbits of differential equations are quite difficult in Flash. Flash permits precision through its programming language, Actionscript, but using this is much more difficult than using the point-and-click interface that is the trademark of Flash. The intention of this project was to provide components that have the most complicated programming already built in, so that the developer only has to worry about the content.

it, we have a short-term aim, and a long-term goal. The aim of this project is to provide components for displaying and animating graphs of functions and solutions of differential equations that may be used by Flash developers to ease their own work in creating instructional materials. In the longer term, we hope that the paradigm presented here might be adopted by others, with a movement toward a creating a library of mathematical instructional movie clips.

These components are intended for Flash developers. If you are not currently familiar with Flash, it should be easy to gain a basic understanding of it using the tutorial materials that come with the software. We estimate that a person familiar with simple computing concepts could learn the basics of Flash in about four hours. We offer no warranties for this estimate.

## 1 Properties

The components are movie clips for Flash. You may use them and even modify them at will, provided that any derivative code is also in the public domain. We ask also that you provide copies of substantial modifications to us, so that we may make them available to others through the web site. The entire package may be obtained at <http://www.math.wsu.edu/idea/Flash/>

The movie clips are small animations that can be used as parts of larger animations. With the appearance of Flash MX such customizable movie clips have come to be called *components*. In this document we will use both terms interchangeably. There are several components in the package.

- **Plot Component:** The main component can plot any number of functions that you specify. It allows you to specify colors and styles, or can revert to default values if you prefer.
- **Point Component:** This can plot a point at coordinates that you specify. Again, you may choose the colors for the point representations. Currently the movie clips use only a disk style of point.
- **Label Components:** There are two label components: one with an arrow indicating the feature it labels, and one without. These can make labels at any points you specify. Thus, you may label points, or simply make text remarks at any location on the plot.
- **Differential Equations:** There is a component that can plot solutions to initial value problems in one or two-dimensional differential equations. You may tell the component whether to plot only forward orbits, backward orbits, or both. You may specify colors for the forward and backward orbits separately.

- **Slide Bar:** This component allows a user to move a slider to control parameters for a plot.
- **Coordinate Display:** There are components to display the plot coordinates corresponding to the current mouse position.
- **Animator:** This provides a way of varying parameters over time. You specify the parameter to be changed, the way it is to be changed, and the time over which it is to be changed.

## 2 Installation

In order to use the package, you must use Microsoft Windows 95, 98, Me, 2000, or XP, or the Mac OS as your operating system, and you should have Macromedia Flash MX installed. It is sufficient to use Flash 5, but this document does not discuss fully how to use the package in that setting. Indeed, the components are really designed for use in Flash MX, and may not function fully in that environment. Since this is a demonstration project, there is no installation package for the components. Download the "Math Components.fla" file from <http://www.math.wsu.edu/idea/Flash>, and place it in the directory

```
\Program Files\Macromedia\FIash MX\FirSt Run\Components
```

That is all that needs to be done. Further documentation on the use of the components is available at the site, in PDF form.

## 3 Use

The concept behind the movie clips is that developers should be able to drag and drop high-level mathematical objects into their Flash movies. In Flash MX, these components appear in a special panel of the workspace, from which the developer can drag the ones she wants to the stage. She then sets some parameters that characterize the behavior of the movie clips in another panel, and in some cases has to do a little actual programming to define functions for the components to operate on. A brief summary of the typical steps involved follows.

1. Drag a plot component to the movie stage.
2. Name the plot component, and set parameters that describe plot colors, backgrounds,

3. Open the Actions panel, and program the functions or differential equations you want to plot.
4. Make a new, higher layer in the movie.
5. Drag any interaction or animation tools or buttons you require to the new layer. Make sure that these refer to the plot by name, and set any parameters to control the ranges and appearance of these tools.
6. Test the movie.

These steps are described much more fully in the project documentation available at the Web site.

## **4 Further Work**

If there is interest, there is tremendous room for further work in this area. The community could use components for polar plots, log plots, and numerous different formats for three-dimensional plots. Additional components for quiz questions and worksheets might be useful. There is the entire subject of linear algebra that could be developed. With enough care in designing such components, they could come to offer a substantial library of mathematical objects available to the entire community. As we have stated repeatedly, this project only constituted an attempt to demonstrate what is possible in this genre. Those interested in collaboration on future developments should contact the author.