

# What is Modellus™?

Modellus enables students to use mathematics to create models interactively.

Creating and exploring mathematical models is a fundamental task in science. With Modellus, students experience minds-on learning while creating, simulating, and analyzing mathematical models interactively on the computer.

To set up a model, students enter conventional mathematical equations and expressions. Constructing an animation of the model is just as easy: choose objects, like images or vectors, and assign properties, like position or size. With an easy-to-use Windows user interface, graphs and tables are also just a mouse-click away.

Modellus can be used as an exploratory or authoring environment. Furthermore, models can be hidden and/or protected. If you are strapped for time, don't worry—Modellus comes with pre-constructed interactive mathematical models that illustrate many scientific concepts.

Modellus was designed by science education researchers to offer a software package with a sound pedagogical basis. Modellus provides teachers and students a powerful new technology for mathematics and science learning.

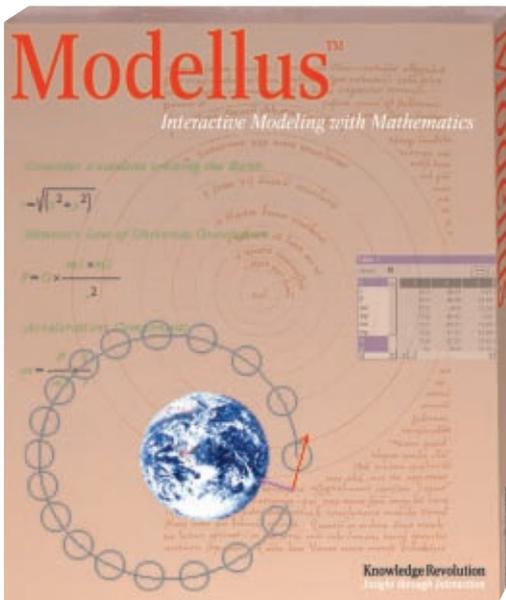
## System Requirements

Requires Windows® 3.1 or later.  
 Minimum: 486 with 8 megabytes of RAM and 5 megabytes of free hard disk space.  
 Recommended: Pentium™ with 8 megabytes of RAM and 10 megabytes of hard disk space.

**Modellus: Single User** ..... \$199  
**Lab Pack Pricing** ..... Call  
**Call for a Free Product Demo**

*Innovative Software in Physics  
 Education Award*

Seventh Annual Computers in  
 Physics Contest



*Mathematical models are an essential part of science. Modellus was designed to help students explore the relationship between mathematics and science.*

Vitor Duarte Teodoro  
 Faculty of Sciences and Technology  
 New University of Lisbon, Portugal



# Product Features

## Multiple Representations for Your Models

Often a graph just isn't enough! Students need to see different representations of the same model in order to fully understand the underlying principles. With Modellus™, you can give your students a tool that allows them to see results in different representations. View mathematical models as animations, graphs, and tables. And you can view all of these representations concurrently, which facilitates instant comparison.

## View Multiple Cases

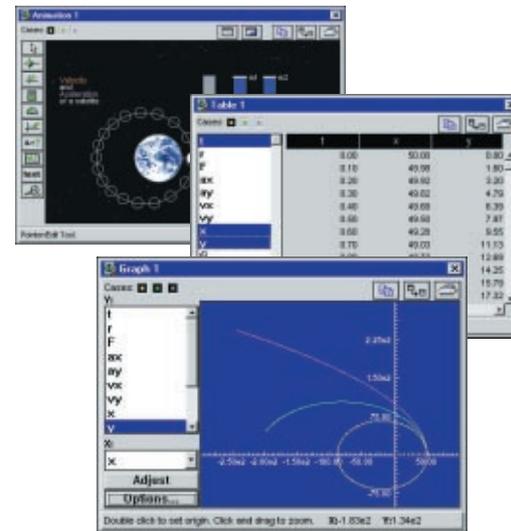
Modellus not only offers concurrent data representations, but it also enables multiple data sets simultaneously. For example, analyze the orbit of a satellite with an XY Graph for three different gravity constants and three different satellite masses at the same time.

## Interact with Your Models

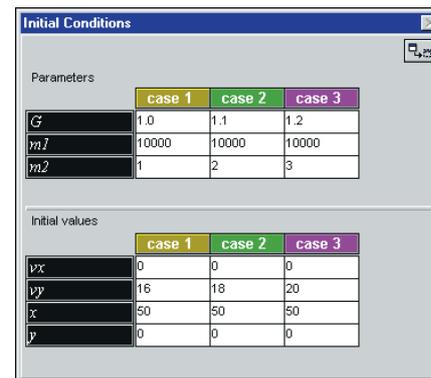
Now you can interact with models in real time to gain powerful insights into the mathematics involved. Typical mathematical programs act as calculators, treating the model as a static entity. Modellus models are interactive. While a simulation runs, students alter variables to see the effects on the animations, graphs, and tables.

## Easy to Learn and Use

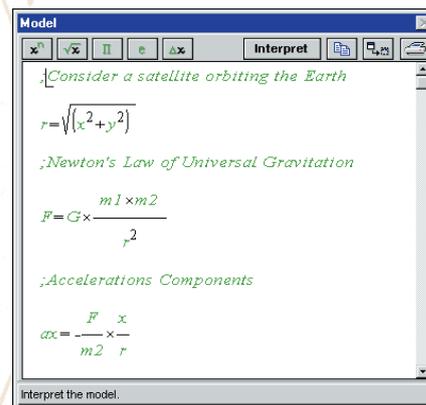
Entering a mathematical model in Modellus is like writing mathematical equations on paper. Therefore, the student does not need to spend valuable time learning the fancy diagrams or specific languages found in other modeling programs.



View several model representations at the same time.



Easily manage multiple data sets.



Start modeling your equations immediately with Modellus' intuitive interface.



Use graphical interface tools like level indicators and analog meters to alter variables of a simulation while it is running.

# Working in Modellus™

You can benefit from *Modellus* immediately after installation. *Modellus* lets you select from a library of ready-to-run experiments that match your content needs. Teaching a course in non-linear mathematics? Open up van der Pol's Equation model. Show your students the simulation of the limit cycle as a graph or animation. Lecturing on population dynamics? Show the Predator/Prey simulation. While the simulation runs, change the predator population to demonstrate important properties of the model.

Because *Modellus* ships with many models from a variety of disciplines, you can use the simulations as starting points for your own work. Is your field of research chemistry? Take a sample chemical reaction model and modify the equations to represent different reactions. Save the model and start your own library of chemical reactions. Share the models with your colleagues and collaborate around them to further your research. You can easily cut and paste data, graphs, and pictures from *Modellus* into other applications. *Modellus* is a powerful tool that can be used as a teaching aid in the classroom or as a simulation engine in your research.

## Modellus Key Feature

Unique interface allows simple management of multiple experiments.

Easily display properties of objects that you could not display in a lab.

Interact directly with objects on the screen in real time.

Supports algebraic and differential equations.

View your mathematical model in multiple representations—visually, graphically, and numerically.

Equation-based modeling environment empowers students to gain insight into the underlying mathematics behind their simulations.

Ready-to-run simulations included with the product can be easily modified or used as is.

Once you are familiar with the *Modellus* environment, it's easy to create your own models from scratch. Enter your mathematical equations as they would appear on paper in the Model window. Choose New Graph and New Table from the menu to create plots and tables. To create a compelling simulation, drag and drop objects from the tool palette into the Animation window. Click on Run and interact with the animation elements while the simulation runs.

If you're having trouble getting started, are looking for tips on using certain tools, or simply don't know what to do next, we offer several solutions. *Modellus* lets you browse through the sample models to see if a certain simulation has the solution you are looking for. Click on Workshops in the Help menu and follow the online tutorials at your computer. Check out the manual. We give added tutorials, tips, and definitions to help clear up your questions. If all else fails, call us. We offer complete customer support services to make sure you are successful with the product.

## Example of Use

Show three different trajectories of a satellite with three different initial velocities, or four different charge curves for a capacitor in series with four different valued resistors.

Show velocity and acceleration vectors of a beta particle in a magnetic field or highlight the trajectory of a bullet shot from a gun.

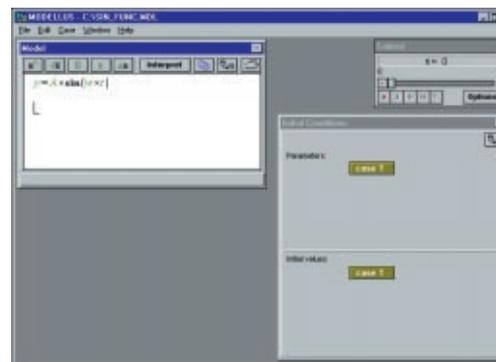
Pull a satellite into a different orbit around the earth or slide the focal point further away from a concave mirror.

Model algebraic relationships like the Ideal Gas Law or Hooke's Law and differential equations like the van der Pol Equation or the Duffing Equation.

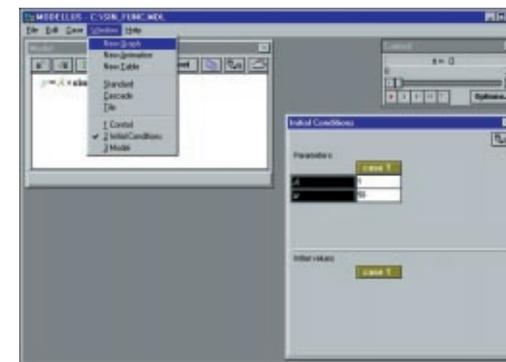
Watch the simple harmonic motion of a pendulum as an animation with a vector representing the resultant acceleration while a graph plots acceleration as a function of time and a table lists the magnitude of acceleration at each time step.

Model the Doppler Effect and understand the mathematical underpinnings of a stationary observer and a moving source or vice versa.

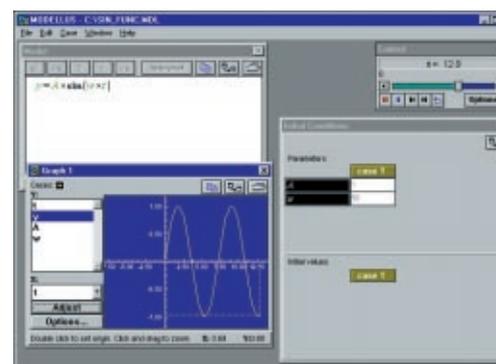
Open a pre-made model of a magnetic field and instantly demonstrate field strength with interactive, animated vectors or alter the model to show the effect of magnetic decay.



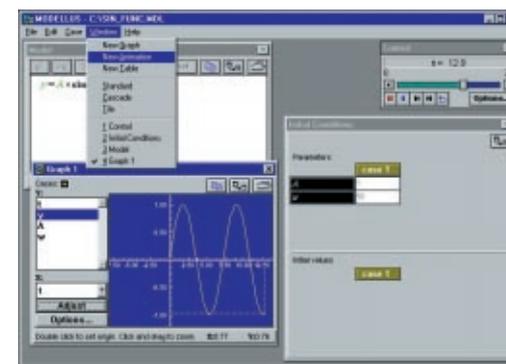
1. Enter a sine function in the Model window just as you would write it on paper. Then click "Interpret".



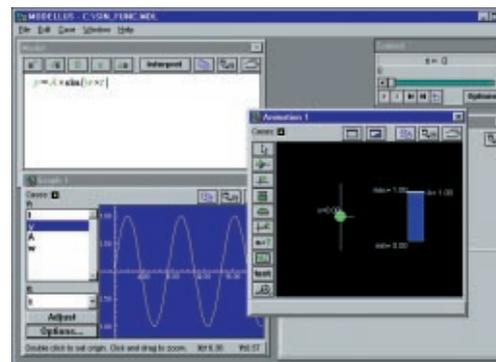
2. Select from the menu to create a Graph of the model.



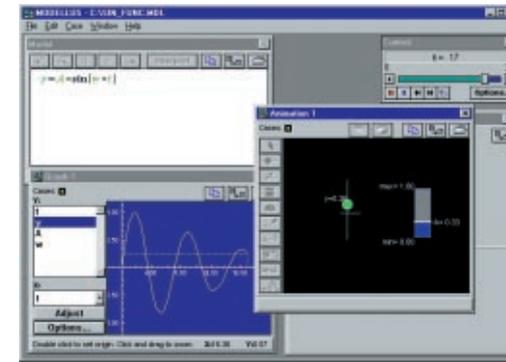
3. Click the Run button in the Control Window and observe the graph.



4. Select from the menu to create an Animation of the model.



5. Drag and Drop from the tool bar to create an animation of a mass attached to a spring with a level indicator for the amplitude.



6. Watch the animation and the graph amplitude decay as you drag the level indicator down with the mouse while the simulation runs.