New Programs on *MathSource*

This announcement lists new *Mathematica* packages, notebooks, programs, and technical reports available on the *MathSource* archive.

Literature Survey of *Mathematica*

Brian L. Evans (January 1994) (0203-207)

A partial index of articles relating to or citing *Mathematica*. Compiled by Brian Evans of the Georgia Institute of Technology, this reference covers many areas of interest, from artificial intelligence to geophysics to symbolic mathematics.

Customizing *Mathematica* with init.m

Robby Villegas (January 1994) (0205-838)

This notebook expands on the *MathUser* article "Customizing *Mathematica* with `init.m`" (*MathUser* #5, Winter 1993-94). It shows how Macintosh and Windows *Mathematica* users can set up customized initialization files.

A Planetarium Package

Terry Robb (February 1994) (0206-132)

The `Planetarium.ma` notebook includes the documentation and examples to go with the `Planetarium.m` package. The package contains over 2500 stars (which is far more than you could ever see with your naked eye), as well as the code to determine the position of all the planets, the Sun, the Moon, and also the odd asteroid or two. Two of the main commands are `PlanetChart[`*year*`]`, which produces a very handy wall chart, and `Ephemeris[`*planet*, *date*`]`, which can be used to determine position and rising and setting times, etc. There is also a `StarChart[`*region*`]` command for generating detailed plots of any section of the sky. Commands called `EquatorCoordinates` and `HorizonCoordinates` can also be used in conjunction with standard graphics commands to produce plots and animations of your own.

Automata

Klaus Sutner (February 1994) (0205-197)

A Mathematica package that generates and manipulates finite state machines and their syntactic semigroups.

The Stellated Icosahedra

Roman E. Maeder (January 1994) (0206-042)

The enumeration of all stellations of the icosahedron was accomplished in 1938. The geometric constructions and combinatorial algorithms used can easily be programmed in *Mathematica*. Its symbolic and graphic capabilities make it well suited to render the solids in a variety of formats. `Icosahedra.m` is a package for rendering all 59 stellations of the icosahedron. Some examples for its use are in the notebook `Icosahedra.ma`.

Uniform Polyhedra

Roman Maeder (February 1994) (0206-165)

`UniformPolyhedra.m` is a package for computing metrical properties of all 75 uniform polyhedra (as well as the two infinite families of prisms and antiprisms) and for graphics rendering. `PolyhedraExamples.m` contains a list of 80 examples, including the names of all uniform polyhedra.

Sierpinski-Menger Sponge

Robert M. Dickau (February 1994) (0206-110)

These notebooks contain the code necessary to display the Sierpinski-Menger fractal sponge, as well as the default output for the code. The sponge is the three-dimensional analog of the one-dimensional Cantor set and the two-dimensional Sierpinski gasket.

Applied Mathematica

W.T. Shaw and J. Tigg (January 1994) (0205-366)

This material contains the longer code sections from *Applied Mathematica: Getting Started, Getting it Done*, by William T. Shaw and Jason Tigg (Addison-Wesley, ISBN: 0-201-54217-X). This book shows how *Mathematica* can be used to solve problems in the applied sciences. The code includes specialized graphics; several *MathLink* examples, including C code and template files; and some extended data analysis examples.

Color Fractal Movie

Doug Stein (March 1994) (0206-323)

This notebook contains the animation mentioned on page 383 of *Applied Mathematica*, by W.T. Shaw and J. Tigg (Addison-Wesley). When fully uncompressed, the notebook requires approximately 9.2 MB of disk space. The source code for this animation is available on *MathSource* as item 0205-366.

matlabio: A MATLAB MAT-file Reader/Writer

Doug Stein (March 1994) (0206-200)

The *MathLink* template program `matlabio` allows *Mathematica* to directly read and write MATLAB MAT-files, which are compact binary files for numerical matrices.

sci2mma: A Filter to Convert Data in Scientific Notation Format to *Mathematica* Input Format

Tyler Perkins (March 1994) (0206-345)

`sci2mma` acts as a filter or file conversion utility to convert occurances of strings of the form `1.234e-5` to `1.234*10^-5`. Thus, a text file produced by a C or Fortran program may be used as input to *Mathematica* using its `Get` function.

Emacs Interface for *Mathematica*

David Jacobson (March 1994) (0202-093)

Math-mode lets you run *Mathematica* under Gnu Emacs and provides a functionality somewhat similar to the notebook interface available on the Macintosh and NeXT. The input is divided into cells. Typing ESC RET submits a cell to *Mathematica* similar to the way SHIFT RET submits the cell on the Macintosh or NeXT. At this point, most similarity ends. There are commands to copy cells, delete cells, etc.

TeX-*Mathematica* for *Mathematica* 2.1 and 2.2 and Emacs 18 and 19

Dan Dill (March 1994) (0202-239)

TeX/*Mathematica* is a set of tools that provide facilities of *Mathematica* notebooks in a UNIX environment, under GNU Emacs. They permit interaction between a text and a *Mathematica* buffer (using David Jacobsen's `math.el` package, which is included) and, if desired, the use of (La)TeX to annotate *Mathematica*-based explorations and programs. Inclusion of *Mathematica*-generated graphics in (La)TeX documents printed using PostScript is supported. The tools also support the automatic generation of *Mathematica* packages from TeX/*Mathematica* documents, using a WEB-like notation. Package generation can be used to document other programming languages. With these tools you can interactively develop and refine teaching and research documents. The interactive nature of the tools encourages *Mathematica*-based exploration as a natural part of the writing process.

Solution of Fermat's Equation

Andrew J. Hanson (March 1994) (0206-288)

This notebook shows a projection from four-dimensional space of the so-called projective variety that represents all possible solutions of the equation $x^n + y^n = z^n$ for varying n. Fermat's Last Theorem states that none of these solutions can correspond to integer values of x, y, and z.

Generating Feynman Graphs and Amplitudes with FeynArts

Hagen Eck and Sepp Kueblbeck (March 1994) (0202-194)

FeynArts is a package for users in high-energy physics who want to calculate differential cross sections and decay rates for processes in field theories using Feynman graphs. The package creates Feynman graphs and analytical expressions (amplitudes) for S-matrix elements and truncated Green functions in renormalizable quantum field theories. It consists of several subprograms, each of which is written to be as general as possible. FeynArts can generate multiloop topologies, insert fields into them, and is not restricted to a certain model (it only has to be renormalizable). FeynArts is based on algorithms that can handle complex models and it has sophisticated graphics facilities.

Signal Processing Packages and Notebooks 2.86

Brian Evans, James McClellan, Kevin West, Wallace McClure, Lena Karam, and Jim Proctor (March 1994) (0202-240)

A hierarchical set of packages to perform basic analyses of signals (functions) and systems (operators). The packages are based on transform theory and implement many concepts from linear systems theory. They support (bilateral) z and Laplace transforms, as well as continuous-time, discrete-time, and discrete Fourier transforms, all in arbitrary dimension. These rule bases can fully justify their answers (i.e, show the intermediate steps) and allow users to specify their own transform pairs. The packages can perform a variety of operations for symbolic, graphical and numerical operations of signals and systems. Symbolic analyses include simplification of expressions, determination of data types, and reasoning about properties of signals, such as stability. For 1-D and 2-D signals, plotting capabilities include discrete time-domain plots, magnitude and phase responses, and pole-zero diagrams, including the region of convergence, for z and Laplace transforms. Root loci can also be plotted for one varying parameter.

NoFillHistogram Package

Michael Ibrahim (March 1994) (0204-433)

This package produces unfilled histograms, with a few options that work much like those of built-in functions such as `Plot`. It also allows a convenient interface to the `Legends` package.

Pseudo-Random Pulse Sequencing

Erik Jensen (January 1994) (0206-020)

The package `PseudoRandom.m` defines a few routines that are useful for working with pseudorandom sequences. These sequences (also called maximum length pseudorandom sequences or MLPRSs) have been used in optimizing time-of-flight spectroscopies in the physical sciences (neutron beam and molecular beam scattering).

Physical Pendulum in a Hamiltonian Formulation

David M. Harrison (February 1994) (0206-109)

Using C-code communicating with *Mathematica* via *Mathlink*, this package solves the undamped pendulum in a Hamiltonian formulation using a variety of Runge-Kutta algorithms including a symplectic integrator. Separate files allow solving the undriven and driven pendulum.

Nuclear Constants

David Harrison (January 1994) (0206-064)

The NuclearConstants package gives access to mass excess, binding energy and atomic masses for most known nuclear isotopes. Each number includes errors in the quantity. The data is as published in the 1986 Nuclear Mass Tables.

Linear Lattice-Ligand Binding Notebooks

Alan R. Wolfe (February 1994) (0206-031)

These *Mathematica* notebooks calculate and plot data for the binding of ligands to an infinite linear lattice. Binding site overlap and cooperative interactions between adjacent bound ligands are taken into account. This is a mathematical model for non-sequence-selective binding of proteins and other small molecules (ligands) to a linear macromolecule such as DNA (the lattice).

Noncommutative Algebra Package and SYStems

J. William Helton and Robert L. Miller (March 1994) (0204-400)

Although processing of commutative expressions is built into *Mathematica*, relatively little support is given to noncommutative expression manipulation.These packages have been developed to fill this void. They implement commands for noncommuting algebra, as well as other functions.

MathSource is accessible by gopher and anonymous ftp *to* `mathsource.wri.com`, *by e-mail (send the message* `Help Intro` *to* `mathsource@wri.com`), *and by direct dialup* (*dial* 217-398-1898 (8 *bits, no partity,* 1 *stop-bit*), *log in as* `new` *and give the command* `Help` *to get started*).