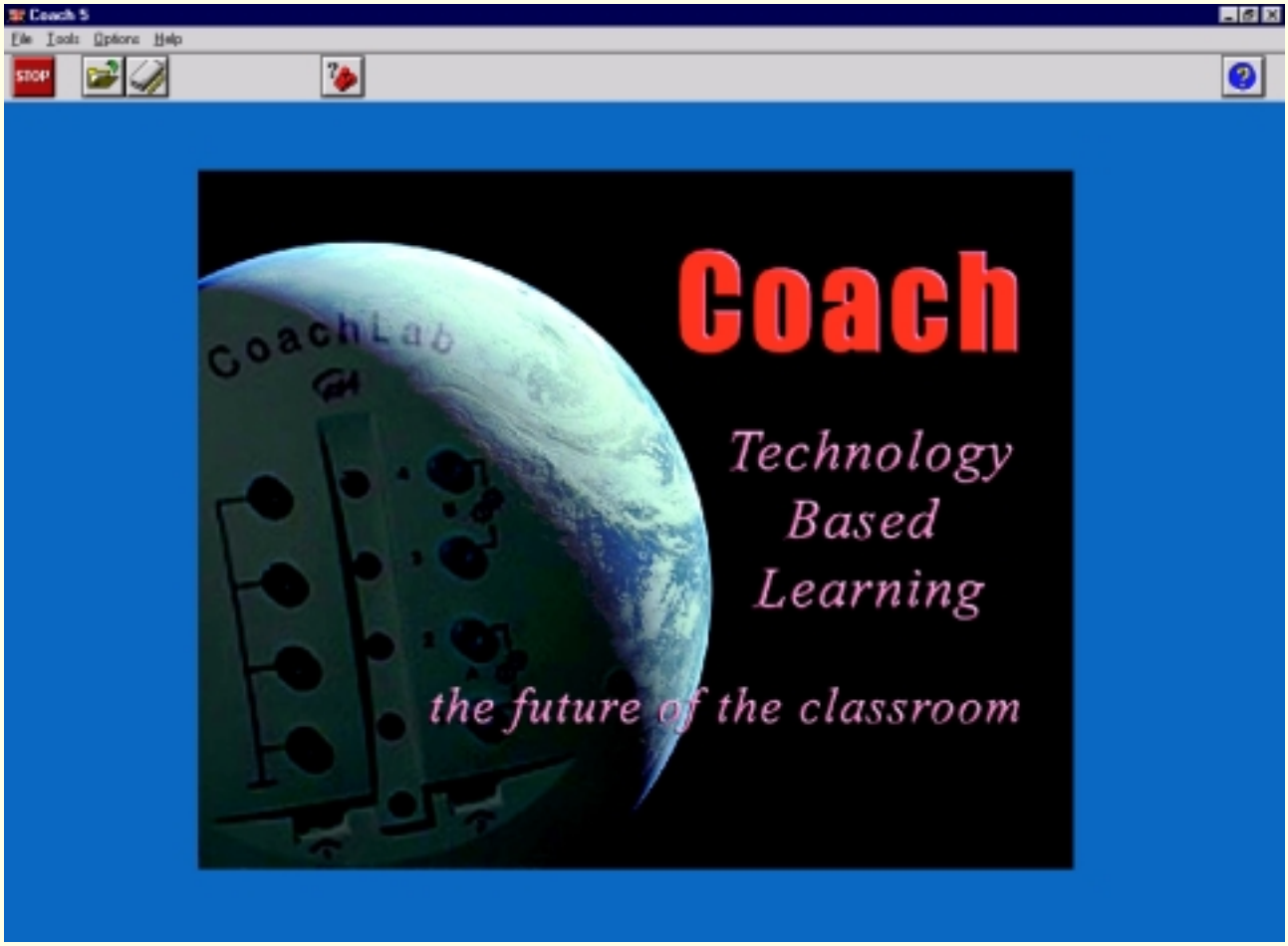
Coach 5

A versatile learning and authoring environment for Science, Technology and Mathematics.



Coach 5 integrates all the tools you need for:

- on-line and off-line measurements and control
- data-video: measurements on science videoclips
- advanced data processing and data analysis
- creating dynamical models.

Coach 5 supports many hardware brands:

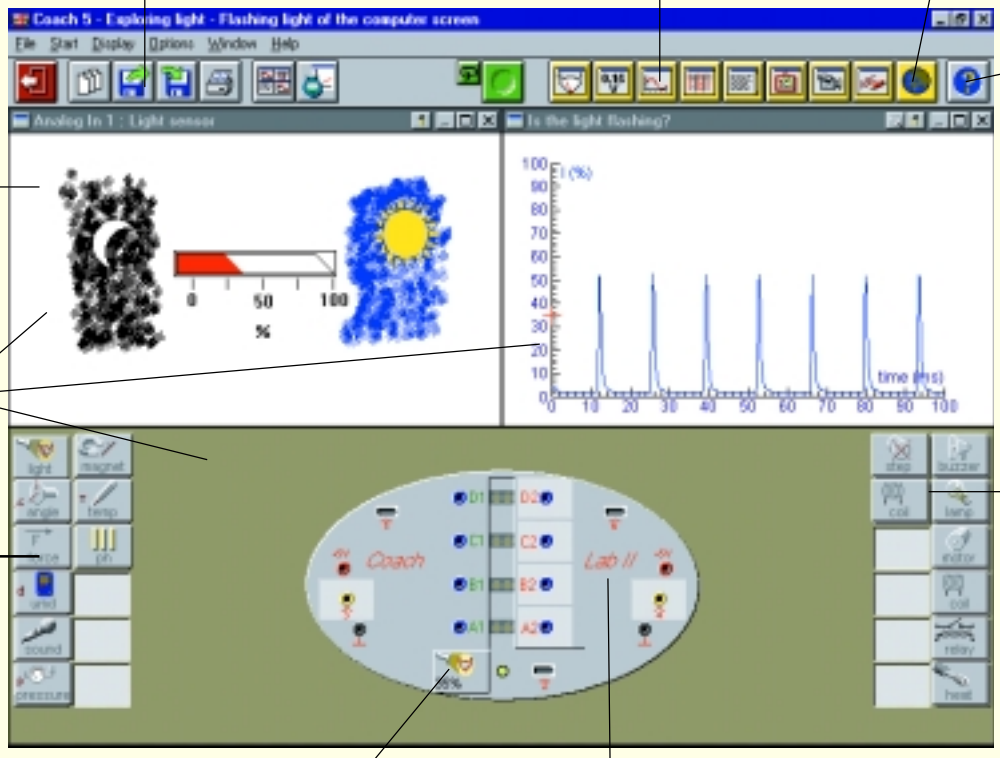
- CMA's: UIA/UIB, CoachLab I and II
- Texas Instruments: CBL™, CBL2 ™ and CBR™
- Fourier Systems: EcoLog™
- LEGO DACTA®: Control Interface, RCX™.

CMA Centre for Microcomputer Applications

Coach 5 for the student

As a teacher you want to supply a variety of ways for students to become involved with the learning content. Coach 5 program gives you opportunities to build such a learning environment and to create exciting and tailor-made multimedia activities for students starting at primary level up to undergraduate. Depending on a student level you can choose from: Junior Fixed, Junior Flexible, Junior Own Lab and Student.

A Coach 5 Activity Screen:



Measurement results, graphs, models, programs can be saved, printed or brought to another program to make a report.

Customizable toolbar buttons for easy control of all functions.

Links to relevant websites.

On-line help and pop-up tool hints.

Data presented in forms of graphs, tables, meters or digital values.

Main window divided into 3 or 4 subwindows.

Set of sensors for measurement activities.

Set of actuators for control activities.

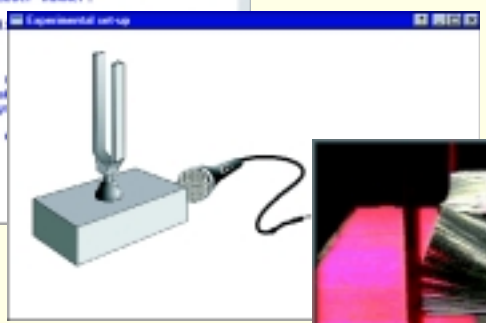
Easy and intuitive drag and drop setup of experiments.

Support of a variety of hardware platforms.

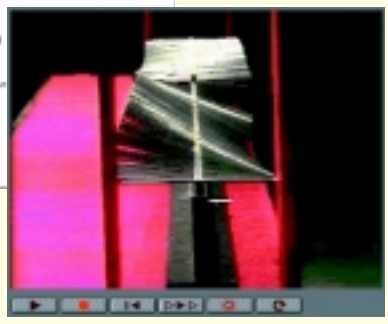
Activity windows can present various kind of content

- **Texts** with activity explanations and instructions.
- **Pictures** with illustrations of experiments and equipment.
- **Video clips** to illustrate phenomena or to make video based measurements.
- **Data** presented in forms of graphs, tables, meters or digital values.
- **Models** (graphical or numerical) which theoretically describe science phenomena.
- **Programs** to control devices and control systems.
- **Links** to internet sites to bring extra resources for students.

Text e.g. with instructions.



Pictures e.g. with experimental setup.



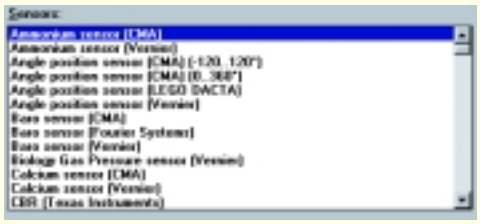
Video e.g. with model bridge demonstration.

Measurement

The measurement activities of Coach 5 enable you to collect on-line and off-line data with sensors. By defining alternative panels the same activity can be used for different hardware platforms.

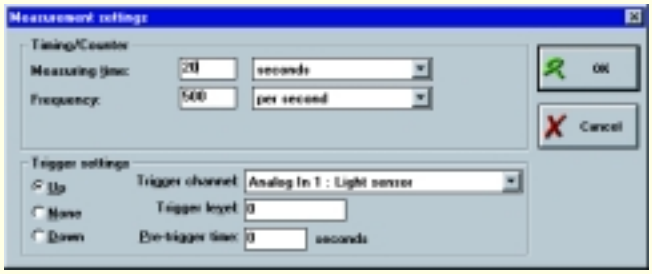
Data acquisition is made easy with many features like:

- Two measurement procedures: time and event based measurements.
- Libraries with all interfaces, calibrated sensors and actuators.
- Calibration program to create or modify a sensor calibration.
- Drag-and-drop way to setup experiments.
- Easy to prepare experiment settings: measurement time and frequency, trigger conditions.
- Prediction of the outcome of experiments.
- Manually entering of data and creating graphs of measured data versus keyboard input.
- Real time data display of sensor values and calculated quantities.
- Multiple sensors and mixed units on the same graph.

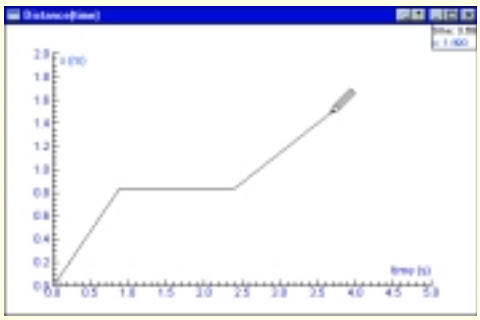


Sensor library

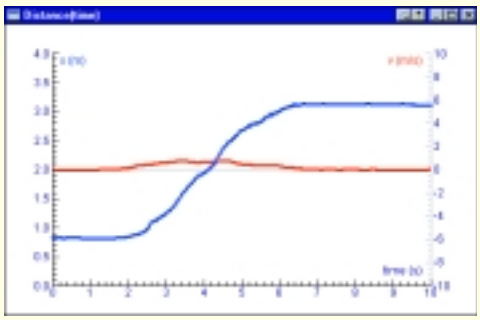
Manual input



Experiment settings



Student prediction



Result of experiment

Data Loggers

Coach 5 has built in features for Data Loggers like CBL™, CBL2™, CBR™ and EcoLog™.

Send settings
No more machine language programming on a calculator keyboard. Simply set your sensors, measurement time and frequency, and press the Send Settings to Data Logger button. Disconnect the CBL from the computer and you are ready to take science measurements in the field.

Get results
Analyzing data is just simple. Simply reconnect the data logger to the PC and press the Get results from the Data Logger button. Your data is uploaded to the computer for analysis and replay. Use the 'Replay' feature to replay the data at the same speed it was collected, or much slower or faster.

The CBL2™ Data Logger

Data Video

With Data Video you can create activities in which students are able to study events which happen outside the classroom. Imagine video sequences showing for example: high divers, soccer kicks, bungee jumping, springs, basketball shots, rides at an amusement park, and so on. By analyzing these simple and complex motions students are using the real world to study theories and concepts.

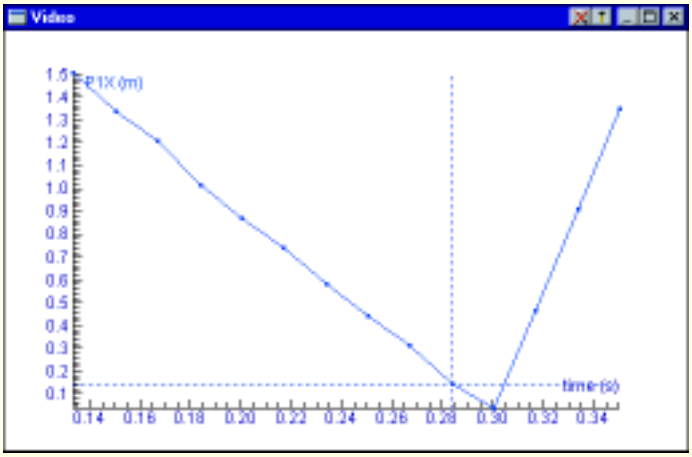
New!

A Data Video activity allows you to:

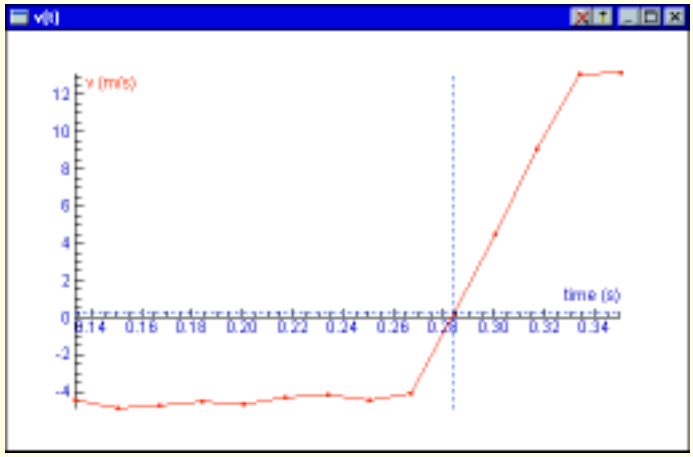
- collect position and time data from digital video clips in the form of points. Data is collected by clicking on the location of the items of interest in each frame of the digital movie.
- plot data, view it in a table, use it for further analysis and modeling.
- calculate new measurement points such as center of mass or distances between points.
- calculate and plot new quantities like velocity, acceleration, energy, momentum.
- compare video directly with synchronized graphs. This helps students to bridge the gap between the concrete visual display of a motion event and its abstract graphical representation.

Softball hitting (sideview)

Softball hitting (topview)



Measured position of the softball



Calculated velocity of the softball

Modeling

The Modeling environment helps you to get students into theoretical thinking. Modeling makes it possible to create quantitative models for a large range of interesting and complex everyday-life phenomena without getting lost in formal operations.

New!

What is modeling?

Instead of an analytical solution the dynamic evolution of the system can be computed step by step. Numerical models allow overcoming mathematical difficulties and conceptually they are easier to understand.

Modeling offers an environment to prepare such mathematical models of continuous dynamic systems. For creating models and giving initial values two types of editors are provided:

Graphical editor

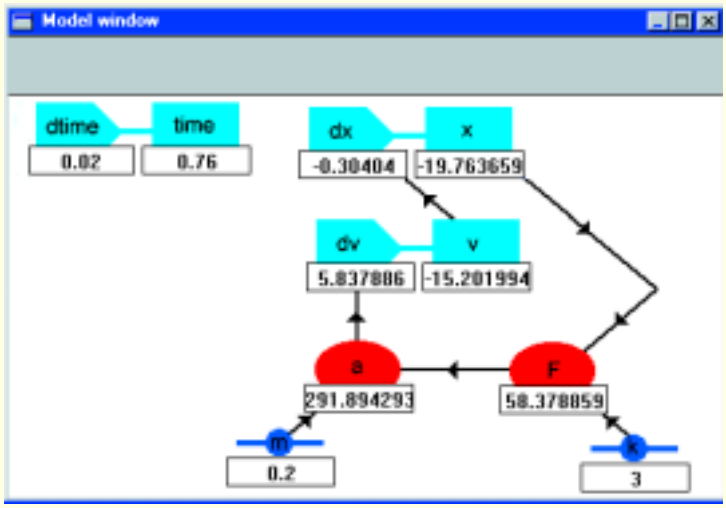
The model structure is represented in a symbolic form that gives a visual representation of variables and interactions between them. The user develops and examines a “concept map” that contains the important conceptual features of the model. The resulting structure is translated by the program into the corresponding set of equations.

Text editor

The model structure is represented in a sequence of formulas, differential and functional equations.

The Modeling process

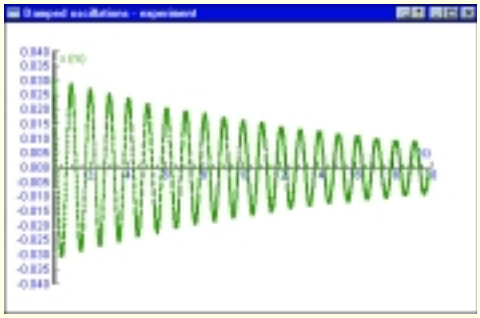
Based on the given numerical model iterative calculations are performed. Results of the calculations can be displayed as numbers, in graphs or tables. The model results can be compared to experimental data. The model can be easily modified or a parameter can be changed so students can test their hypothesis and make links between the real experiment and the theoretical model.



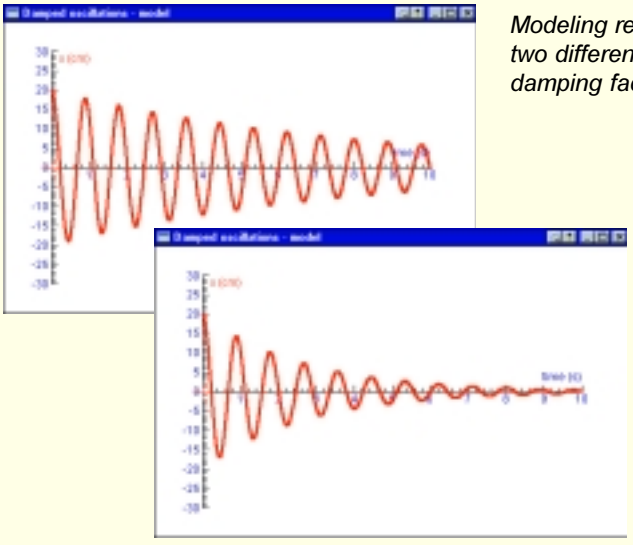
Graphical model of oscillations.

Model: **Initial values:**

Model of damped oscillations. Every parameter can be easily changed to allow simulations.



Experimental results of damped oscillations.



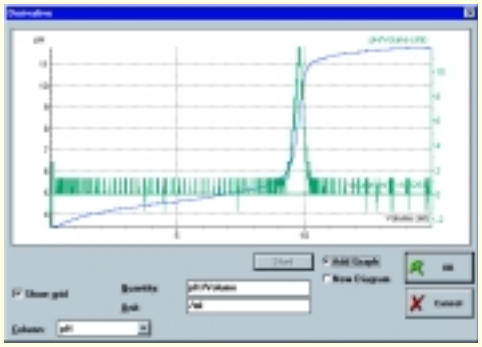
Modeling results for two different damping factors.

Data processing and analysis

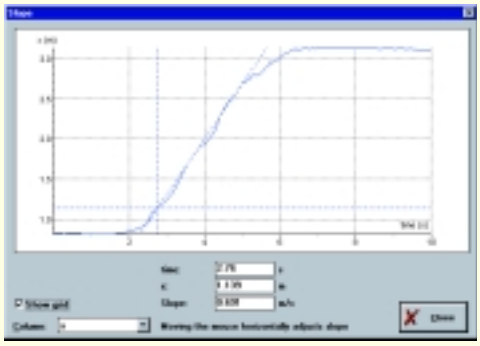
The data collected in measurement, data video and modeling activities can be further processed with the help of many advanced tools. The data processing and analysis tools are closely connected to the graph and table windows. These windows are synchronized: e.g. selecting a point in a graph will highlight the same point in the corresponding table.

Tools for graphs

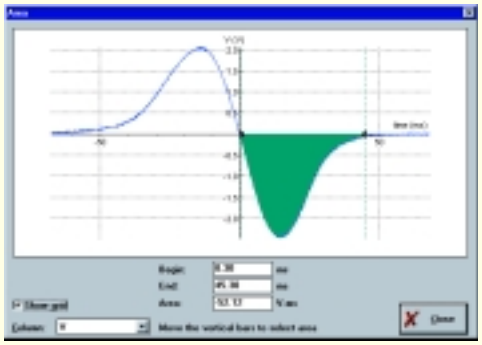
- **Data display**: e.g. X-Y plots and multiple Y-axes.
- **Zoom in/out**: enlarges a part of a graph or zoom to fit.
- **Scan**: presents the coordinates of points.
- **Slope**: determines the slope in any point of the graph.
- **Area**: calculates the area under a graph.
- **Function fit**: enables to approximate a graph by a standard mathematical function. A suitable function has to be chosen from the list of standard functions first.
- **Signal Analysis**: finds the spectrum of a signal by using Fourier Transform or Linear Prediction.
- **Select data**: reduces the number of data points in a graph.
- **Smooth graph**: interpolates a curve based on limited number of data points.
- **Filter graph**: smoothes a curve by averaging values in small intervals.
- **Derivative**: calculates the derivative of a set of data.
- **Integral**: calculates the integral of a set of data.



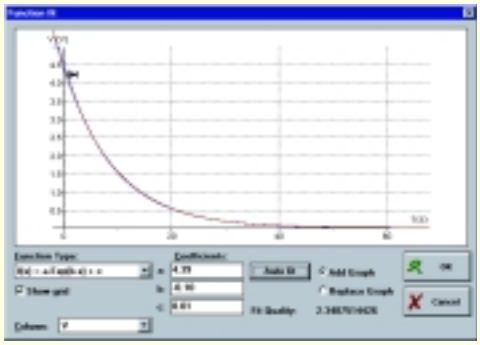
Looking for the equivalence point: derivative of a titration curve.



Using slope to find the velocity at a certain moment.



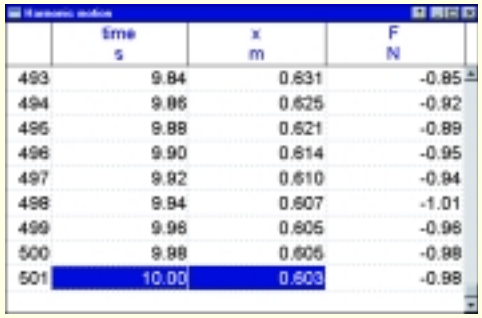
Determining the change of magnetic flux: area under a graph.



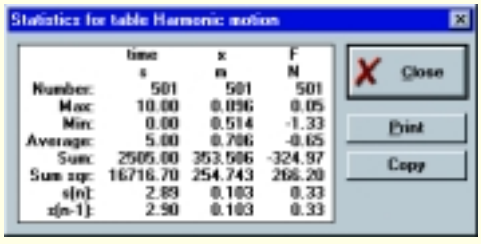
Finding the RC-constant with help of function fit (exponential function).

Tools for tables

- Entering formulas for new columns - advanced formula editor is available.
- Columns with manually entered values.
- Cell and Row editing.
- Statistics: shows statistical information about the values in each column.
- Import data (Coach 4, Coach Junior, DIF, TXT).
- Export data (DIF, TXT).



	time s	x m	F N
493	9.84	0.631	-0.85
494	9.86	0.625	-0.92
495	9.88	0.621	-0.89
496	9.90	0.614	-0.95
497	9.92	0.610	-0.94
498	9.94	0.607	-1.01
499	9.96	0.605	-0.96
500	9.98	0.606	-0.98
501	10.00	0.603	-0.98

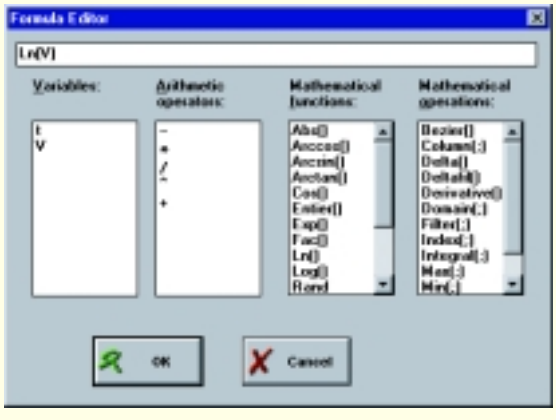


Statistics for table Harmonic motion

	time s	x m	F N
Number:	501	501	501
Max:	10.00	0.896	0.05
Min:	0.00	0.514	-1.33
Average:	5.00	0.706	-0.65
Sum:	2505.00	353.586	-324.97
Sum sqr:	16716.70	254.743	266.20
s[n]:	2.89	0.103	0.33
s[n-1]:	2.90	0.103	0.33

Close | Print | Copy

Table and its statistical information.



Formula Editor

Ln(V)

Variables: t, V

Arithmetic operators: - * / ^ +

Mathematical functions: Abs() Arccos() Arcsin() Arctan() Cos() Entier() Exp() Fac() Ln() Log() Rand

Mathematical operations: Bezier() Column[;] Delta() Deltat() Derivative() Domain[,] Filter[;] Index[;] Integral[;] Max[;] Min[,]

OK | Cancel

Formula editor.

Control

The Control environment of Coach offers several modes of programming with increasing difficulty. Coach programming environment allows monitoring all the inputs and outputs of the control system while a program is running. Data can be displayed in graphs, tables or as values for further study of the system behavior. The supported models range from fixed models (Crossroads), models to be built from elements (LEGO DACTA models) up to student designed models with CoachLab I and II.

Four modes of programming

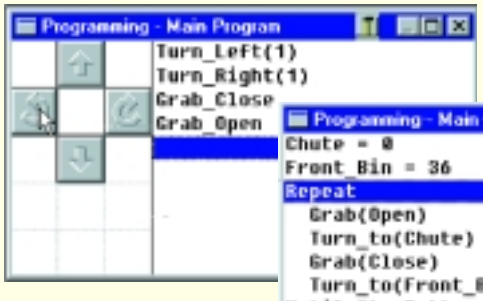
1. Manual control mode
Student can read connected sensors and control actuators by simply clicking on the on-screen panel to find out their behavior.

2. Instruction mode
Students can make programs by manually controlling a system via so-called 'Instruction buttons' on the screen. Students learn that systems can be controlled by commands.

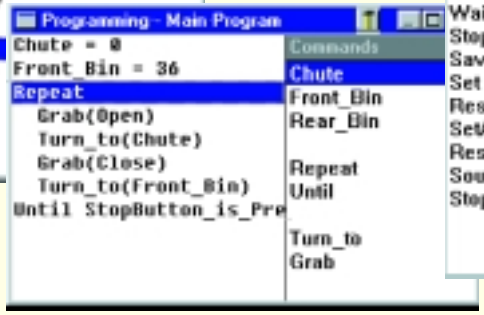
3. Micro-world programming mode
A 'micro-world' consists of a pre-defined set of commands tuned to a particular model. Students learn to write control programs by selecting statements from a command list on the screen.

4. Free programming mode
Experienced students can program freely, i.e. by choosing commands from the complete list of available Coach Language commands, or by typing commands. It is also possible to make own commands and add these to the list with programming commands.

Becoming familiar with the Robot arm in manual mode.



Creating a program by clicking instruction buttons.



Commands in the Micro-world for the Robot arm.

List of Coach Language commands.

RCX - the programmable LEGO Brick™

Special for the LEGO DACTA® Programmable Brick - RCX™ a new feature has been added. The program created in the control environment can be downloaded into the Programmable Brick.

Students at work with the LEGO DACTA® Programmable Brick™.

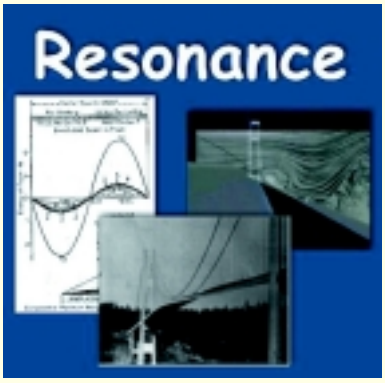
Author environment

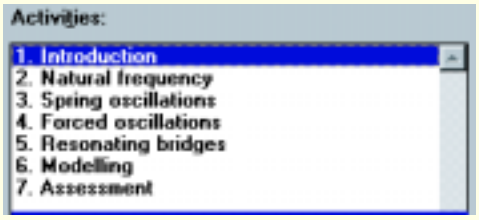
Create your own multimedia activities, labs and curriculum materials in the Coach environment using Author facilities. Coach 5 lets you insert your own instructions, notes, and text, along with your own images, pictures, and art, even add your own video clips to activities. You never need to create paper instructions unless you want to.

Authoring facilities

In Author environment you can:

- select the mode students will use to work in an activity. The modes range from Junior Fixed, which gives students access only to a few necessary controls, up to Student mode that allows students to use Coach as an open set of tools.
- set measurement time and frequency, graph layout and scaling, trigger settings, sensor choices, and more.
- predefine sensors for experiments. With help of the Sensor Editor you can also edit sensor settings and calibration, create your own sensor profiles or change the appearance of a meter or diagram.
- set the movies to collect video data.
- create dynamical models for hypothesis testing.
- add links to relevant Internet pages or to other files.
- prepare a programming environment where students can create programs that can control the output channels or simple regulate measurement activities.
- set the screen layout, the combination and location of instructions, images, videos, diagrams, values, or tables.



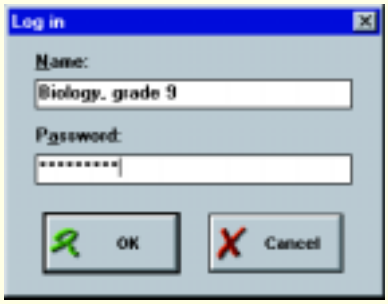


Title screen and list of activities of the 'Resonance Project' - an example of Coach 5 Multimedia Projects.

Management features

To support practical and intensive use in schools Coach 5 offers the teacher two extra tools:

- **Project manager** to help you organizing all activities and projects.
- **Profile editor** to prepare the user profile in which Coach will start.



Login as the user 'Biology, grade 9'.

Languages

Coach 5 is available in many languages: English, Czech, Croatian, Dutch, Danish, French, Finnish, German, Greek, Hungarian, Italian, Latvian, Norwegian, Polish, Portuguese, Slovak, Spanish and Swedish.

Minimal system requirements for Coach 5:
PC with 486 processor
4 MB RAM
10 MB of free disk space
Windows 3.1x or higher
CD-Rom drive recommended

Coach 5 is developed by the AMSTEL Institute of Universiteit van Amsterdam and distributed by Foundation CMA.

Foundation CMA is an enterprise arm for resources developed by AMSTEL Institute of Universiteit van Amsterdam.

AMSTEL Institute (Amsterdam Mathematics, Science & Technology Education Laboratory) is an expert center for research and development of hardware, software and teaching materials.

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