Pintar
*V*irtuaLab™
Mechanics

Chapter Four
Mechanics

Overview

Introduction

The Pintar ***V*irtuaLab**™ Mechanics module has certain features that are different from any other Pintar ***V*irtuaLab**™ modules.

- If you are new to Pintar ***V*irtuaLab**™ you might want to familiarize yourself with the components which are found in the interface.
- Next, the fastest way of using the Pintar ***V*irtuaLab**™ is by doing an experiment. This manual will give you step-by-step instructions on conducting an experiment.

In this chapter

This chapter covers the following sections;

Section A
Components of the Interface

Overview

Introduction

In order, to use the Pintar ***V*irtuaLab**™, you need to be familiar with the different components that you will be using in conducting your experiment.

In this section

This section covers the following topics;

The Work Window

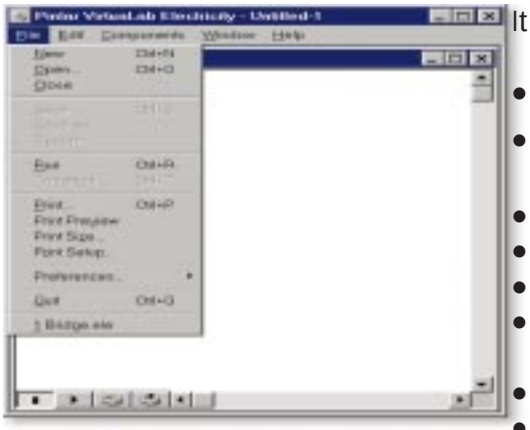
Introduction

The Work Window is

- A simulation of the real lab, so, you can create and conduct your experiments freely.
- The space where your electrical components are connected together to create an experiment.

The Types of Menus

The File menu



It contains:

- Starting new experiment
- Opening a previously saved experiment
- Closing the active experiment
- Saving an experiment
- Saving a new experiment
- Reverting an experiment to its most recently saved state
- Running/playing your project
- When an experiment is running, choosing 'Run/Pause' command will pause the experiment
- Stopping to editing your experiment
- This is exactly equivalent to clicking on the 'Reset' button at the bottom of the Work Window
- Printing projects
- Setting preferences
- Ending work session

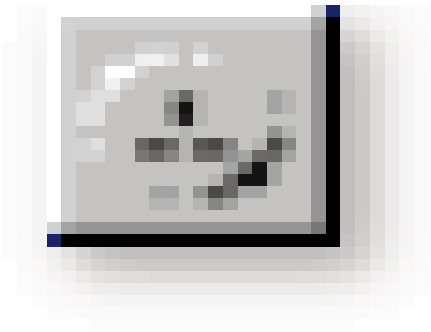
The Edit menu

It contains:

- Undoing last action
- Editing an experiment
- Cut
- Copy
- Paste
- Deleting one, more or all components from the Work Window
- Selecting all components on the Work Window
- The 'Push Back' command pushes the selected object back in order to see the objects behind it.

The Types of Menus

The View menu



It contains:

- The Zoom-In tool magnifies the Work Window by a factor of two. This is exactly equivalent to clicking on the 'Zoom In' button at the bottom of the Work Window
- The Zoom-Out tool decreases the magnification of the Work Window by half
- This command presents a View Size dialog to set these parameters about view
- The Snap Move feature, when selected, causes an object to snap to predefined grid positions.
  When this feature is in effect, a check appears before the command
- This toggle hides and shows the rulers
- This toggle hides and shows x, y axes in your Work Window
- This toggle hides and shows the Object Bar in the left side
- This toggle hides and shows the Status Bar
- Tracking
  - Tracking Off
    Turn off trace of the experiment in the Work Window
  - Tracking Every 1, 2, 4, 8, 16, 32, Frames
    Turn on trace of the experiment in the Work Window at different tracking rate. More frames means longer time interval.
  - Others
    This command opens a Tracking Frame dialog to let you choose your own desired tracking rate.
- The 'Time Step' command opens a Time Step dialog to let you set the time step and accuracy in running experiments.

The Types of Menus

The World Menu

It contains:

- The 'Gravity' command opens a Gravity dialog to set the gravitational forces.

  The gravitational forces can be turn on or off by selecting between the three modes,
  - None,
  - Vertical, and
  - Planetary

  Options in the Gravity Dialog
- The 'Air Resistance' command opens the 'Air Resistance' dialog to set the forces caused by air resistance
- When this option in the World menu is selected, the collision detection feature is turned off. Objects that are collision bound simply slide over each other

  Turning off collision detection speeds up an experiment when no collision is expected in the experimenting
- When this option in the World menu is selected, objects do not rotate, even when a torque is applied to the object

  Turning off rotation speeds up an experiment when rotation is not monitored in the experiment

The Measure Menu

It contains the functions for measuring your experiment

The Types of Menus

The Vector Menu

Show one or more Vector(s) from the Vector menu, a check is shown for the selected vector. The vectors in Vector menu are dim until you select an object by clicking it in the Work Window.

The Window Menu

The Window menu offers the following commands for arranging multiple views of multiple documents in the application window :

- This command arranges multiple open windows in an overlapped fashion
- This command arranges multiple open windows as non-overlapping tiles
- This command arranges the icons of minimized windows at the bottom of the main window
- Pintar VirtuaLab Waves displays a list of currently open document windows in the Window menu. Choose a document from this list to make its window active

The Types of Menus

The Help Menu

It contains:

- The Help system is easy-to-understand and provides assistance to using the Pintar VirtuaLab Optics. The Help system opens in a separate window; and can be kept open, while you work on your experiment.

  Note:
  The Pintar VirtuaLab Optics is also equipped with 'context-sensitive' Help.

- This option opens a panel, which contains information regarding your copy of Pintar VirtuaLab Optics

The Object Bar

Introduction

The Object Bar holds the tools for creating and manipulating objects.

The tools are as follows:

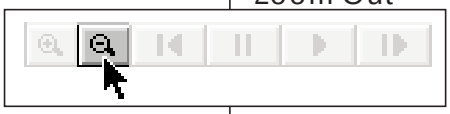
- Selection Tool
- Rectangle
- Polygon
- Gear (Belt)
- Spring
- Rods
- Pulleys
- Hinge Joint
- Circle Slot
- Force
- Motor
- Magnetic Field
- Circle
- Gear
- Gear (Belt)
- Ropes
- Damper
- Pin Joint
- Slot Joint
- Curvilinear Slot
- Linear Motor
- Electrostatic Field
- Text Tool

The Control Panel

What is the Control Panel

The Control Panel consists of the

- Zooms in (or Play),
- Resets
- Pauses
- Runs and
- Steps

Button	Function
Zoom In 	The Zoom-In tool magnifies the Work Window by a factor of two. The new view area is centered on the area around the pointer.
Zoom Out 	The Zoom-Out tool decreases the magnification of the Work Window by half.
Reset 	Click on the Reset button resets the experiment to its original edit mode.
Pause 	Click on this button to 'pause' the experiment. When an experiment is pausing, the objects cannot be edited. Click on 'run' button to continue this experiment.
Run 	Click on this button to 'run' the experiment. When an experiment is running, the objects cannot be edited. Click on 'pause' button to pause the experiment
Step 	A single click on this button moves the experiment forward by one step. In tracking mode one step is determined by the 'Tracking' setting in the World menu

Section B
The Experiment

Overview

Introduction

Pintar VirtuaLab Mechanics is a powerful simulation laboratory for Newtonian mechanics on your desktop!

Through a user-friendly Work Window, you create experiments by assembling and altering the properties of each virtual object as you progress.

Experiments come to life with stunning accuracy and results are immediate.

section

This section covers the following topics;

Background

Experiment goal

In this tutorial, the goal is to put together a simple experiment that would verify Hooke's Law.

Objective

To discover the relationship between applied force and extension of an elastic material

Components

For this experiment, you would need the following components:

- A spring and
- A circular mass object

Experiment Set-Up

Designing the experiment

Follow these steps to start designing your experiment

Step	Action
1	To start a new project, select 'New' from the File menu
2	To draw (place) a mass object on the VirtuaLab, • Select the circle tool in the Toolbox. • Move the cursor to the VirtuaLab, • click and drag in a downward diagonal direction.
3	To move an object, click on the object and drag it towards the left side of the VirtuaLab
4	To set the parameters of the circle mass object, double-click on the circle mass. **Note:** A properties dialog panel for the circle will appear. You should be in the 'Attributes' group of parameters as indicated by the tab above the parameter settings.

Experiment Set-Up

Step	Action
5	Set the parameter to: • For the Position parameters, set 'X' to 1, and 'Y' to 3. • Click on the 'Materials' tab. Set the 'Mass' to 1 kg • Click on the 'Vectors' tab. In the scrolling list, select 'Gravitational Force' and click the 'Show magnitude' checkbox
6	To take a spring, select the spring tool in the Toolbox Adjust the endpoints of the spring so that they are aligned in a vertical straight line with the center of the circle mass. • Click and drag on the endpoints to align them.
7	To connect one endpoint of the spring to the circle mass and fix the other endpoint to the VirtuaLab. **Note:** You do not have to explicitly 'fix' an endpoint of a constraint to the VirtuaLab. Any endpoint that is on the VirtuaLab is considered fixed to it.

Experiment Set-Up

Step	Action
8	Click on the circle mass and drag upwards to the VirtuaLab such that the spring looks about two inches (five centimeters) long.
9	To set appropriate parameters for the spring, double-click on the spring to open its properties dialog panel.
10	Set the spring constant to 10 N/m. **Note:** Check that the rest length and current length have the same values. If the values are different, the spring is in either compression or extension
11	To annotate or label your experiment, • select the Text tool in the Toolbox and place it to the desired location • Double-click on the text object, and the text properties dialog panel appears.

Experiment Set-Up

Step	Action
12	To save your experiment, select 'Save As.....' from the file menu **Note**: If you are using a free trial version of Pintar ***Virtua*Lab**$_{TM}$ Mechanics, you will not be able to save your experiment because this feature has been disabled

Running your experiment

Follow these steps to run your experiment

Step	Action
1	To run your experiment, click on the 'Run' button in the Control Panel
2	To stop your experiment, click on the 'Stop' or 'Construct' button in the Control Panel.
3	To add air resistance, • Select 'Air Resistance...' from the World menu. • Set the air resistance to 2/s
4	To run your experiment again, click on the Step button, not the Run button. The mass object moves just slightly
5	To take readings for record, note down the 'y' value. This is the initial position of the mass

Experiment Set-Up

Step	Action
6	Click on the Run button and wait for the oscillating mass to stop
7	Records its 'y' value again 8Subtract the first reading from the second reading, and the difference is the extension of the spring caused by the mass object
8	Subtract the first reading from the second reading, and the difference is the extension of the spring caused by the mass object

To edit your experiment

Follow these steps to edit your experiment

Step	Action
1	Stop the current experiment and repeat steps 4 to 10 of the experiment set-up
2	Change the mass of the circle object to 1.5kg
3	Click on the 'Run' button again
4	Do this a few more times, each time increasing the mass of the circle object by 0.5kg
5	To use magnification, click once on the magnifying glass with a minus sign in the Control Panel. **Note:** You'll see that the VirtuaLab has been scaled down to give you more VirtuaLab room to work with
6	To end your work session, select '*Quit*' from the File menu

Observation

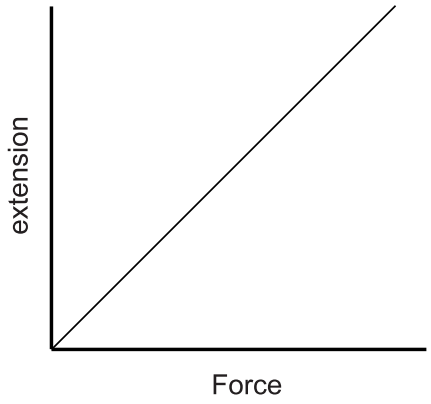
Findings

With the data collected, tabulate as shown below

Force N	*y1* mm	*y2* mm	*Extension*, y2 - y1 mm	*Extension* mm *Force* N
0.0				
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				

Plot the graph

Plot a graph of extension (y-axis) against force (x-axis).
The diagram below shows what the graph may look like.



Troubleshooting

Introduction

In the unlikely event, you encounter a problem with Pintar VirtuaLabTM, it may be helpful to see what are the common problems faced by users and the corresponding causes and suggested solutions.

Note:
In the event the problem that you are facing is not listed here, we will be happy to hear from you. Contact :

Customer Service Department:
info@pintarmedia.com
Technical Support Department:
help@pintarmedia.com

Problem

I cannot run Pintar VirtuaLab Mechanics

Possible causes	Possible solutions
The Pintar VirtuaLab Mechanics program file is damaged	Reload the Pintar VirtuaLab Mechanics program file from the original program disk
The operating system in your PC computer is not Windows 95 or Windows NT.	Pintar VirtuaLab Mechanics will not run on Windows 3.1 or Windows for workgroup 3.11, because this product is a full 32-bits program which runs only on 32-bits operating system like Windows 95 or Windows NT.

Troubleshooting

Problem

The simulation is slow

Possible causes	Possible solutions
The time step of each frame is too small, or the accuracy of calculations is too high	Increase the time step of each frame. Select 'Time Step…' from View menu to set the time step and accuracy
Your PC is too slow	Upgrade your PC to a faster one. Sorry!

Problem

The simulation is too fast

Possible causes	Possible solutions
The time step of each frame is too large	Decrease the time step of each frame. Select 'Time Step…' from View menu to set the time step

Problem

Something seems wrong during simulation

Possible causes	Possible solutions
Mass objects overlapping	Mass objects MUST NOT OVERLAP each other, except when they are connected by a pin joint. The result of simulation may be unpredictable if mass objects overlap. Move these overlapping mass objects aside so that they no longer do so

Possible causes	Possible solutions
The accuracy of calculation is too low to solve this experiment.	Increase the accuracy in simulating this experiment. Select 'Time Step...' from View menu to set the accuracy to 'Extremely Accurate'. If you want to get more accuracy, simply increase the slices of each time step. But, it means that more time would be needed to calculate each frame.

Problem

The Image On The Monitor Looks Scrambled.

Possible causes	Possible solutions
Your video card is incompatible with your monitor	Ensure that the refresh rate for video and monitor are the same