The Sense8 Partner Development Program Presents:

3D Visualization in Simulink Using VRo

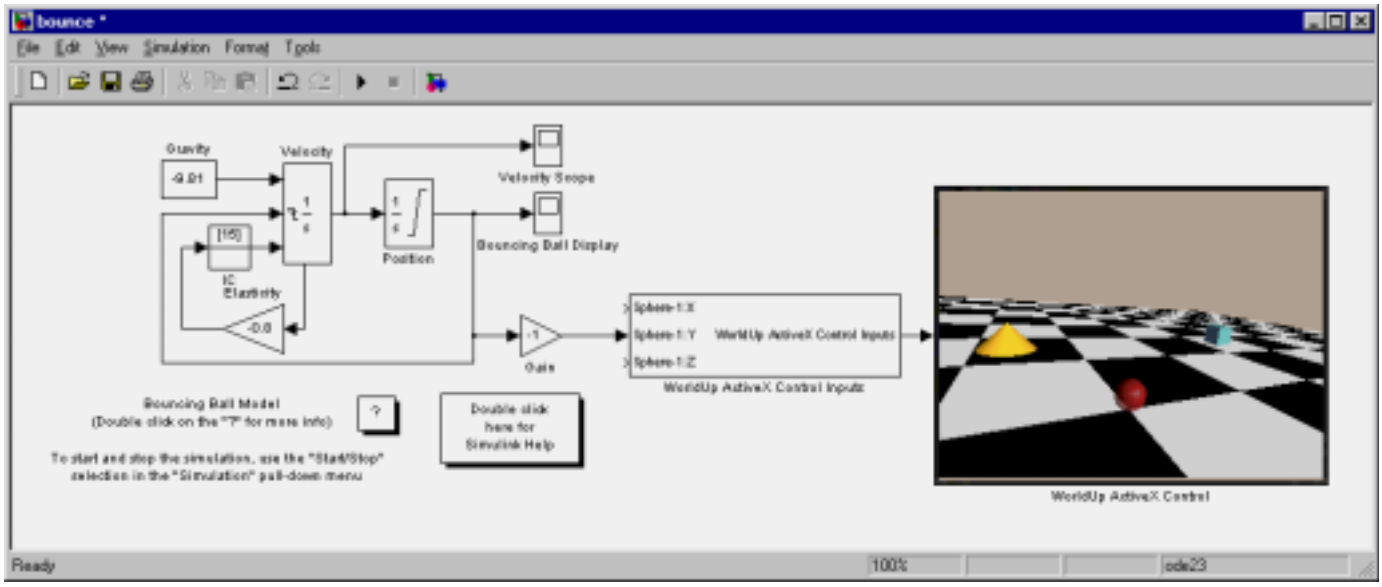


Figure 1*- Illustration of a WorldUp ActiveX Control embedded within a Simulink diagram and connected using VRo.*

Overview

In this tutorial you will use Sense8's ***world****up* together with MathWorks' Simulink to visualize the familiar Simulink "Bounce" demonstration diagram. The purpose of this tutorial is to illustrate just how easy it is to add the power of 3D visualization to a traditional Simulink simulation. For examples of more complex 3D visualizations using this method, please visit the Sense8 website at www.sense8.com.

Requirements

In order to do this tutorial, you will need the following :

- Sense8's ***world****up R5* development environment and ActiveX Control
- Sense8's MATLAB IDE Plugin
- Simulink (3.0 or higher)
- Terasoft's VRo

This is an introductory level tutorial, which means no specific knowledge of ***world****up* or Simulink is required.

Introduction

This tutorial is comprised of 2 parts :

Part 1 – Setting the Scene The first part uses Sense8's ***world****up* and shows you how to quickly create a 3D scene for use in Simulink.

Part 2 – Visualizing the Simulation The second part uses Simulink and shows you how to connect Simulink outputs to the 3D scene created with ***world****up* in Part 1.

Part 1 - Setting the Scene

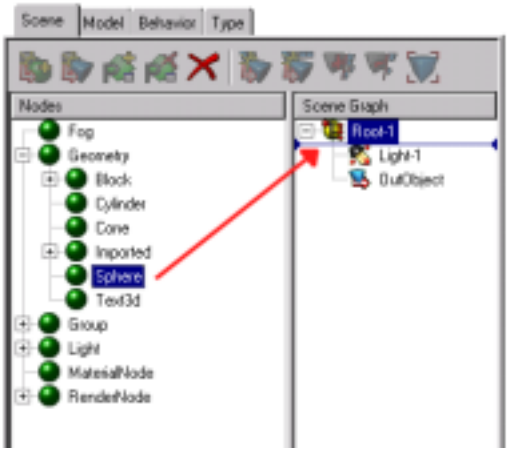
1) Create a 3D Scene in *world*up

a) Start WorldUp.

b) Create a ground plane for reference. The easiest way to do this is either by creating a block and changing it's width, height, and depth values to resemble a floor plane, or else simply import the model "*Benchf.nff*" from the ***world****up* 'Models' directory.

☝ **NOTE** *If you're not familiar with **world**up, refer to the Model Workview section for how to import models, or simply switch to the **Model WorkView** tab and hit the "Import New Model" icon*.

c) Create a sphere that will be used to represent the bouncing ball. You do this simply by dragging the sphere type (green ball) from the type pane to the scene graph pane in the ***Scene WorkView*** :



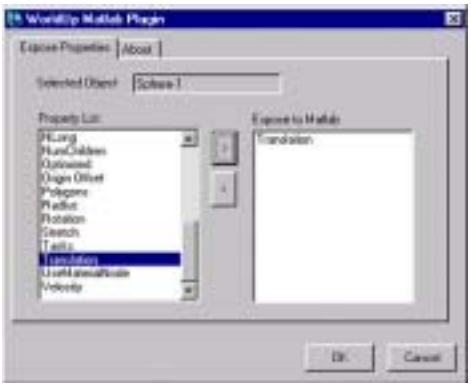
*Creating a Sphere in **world**up*

2) Expose the Sphere's Properties to Simulink

a) Select the Sphere-1 object you created.

b) Select *File -> Plugins -> Expose to Matlab* from the ***world****up* main menu.

c) Add Sphere-1's 'Translation' property from the Property List box and hit OK. The translation property will now be picked up by the Simulink parser and an input created for it when you load your project in Simulink.



Exposing A Property to Simulink

3) Finally, Save Your Project

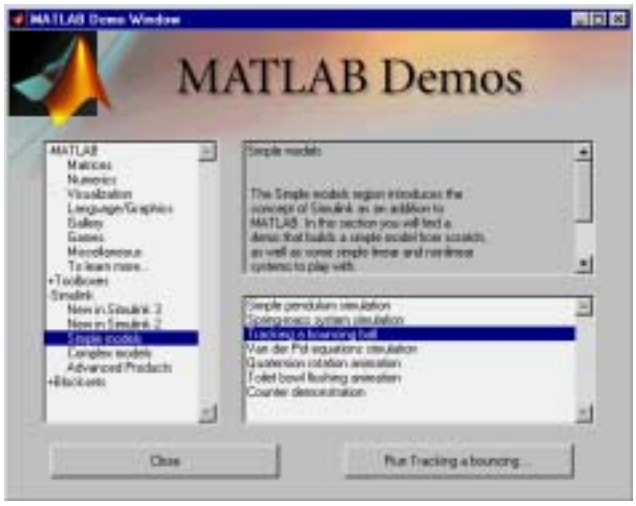
a) Select *File -> Save* from the ***world****up* Main Menu. This will save your 3D scene as a ***world****up* project file (an UP file) which you will load in Simulink.

Part 2 – Visualizing The Simulation

1) **Open the MATLAB provided Bounce Demo in Simulink**

   a) Start MATLAB. Run `demo`.

   b) Open the Simulink ***Tracking a Bouncing Ball*** demo from the Matlab Demo Window. This will launch Simulink with the Bounce diagram loaded.

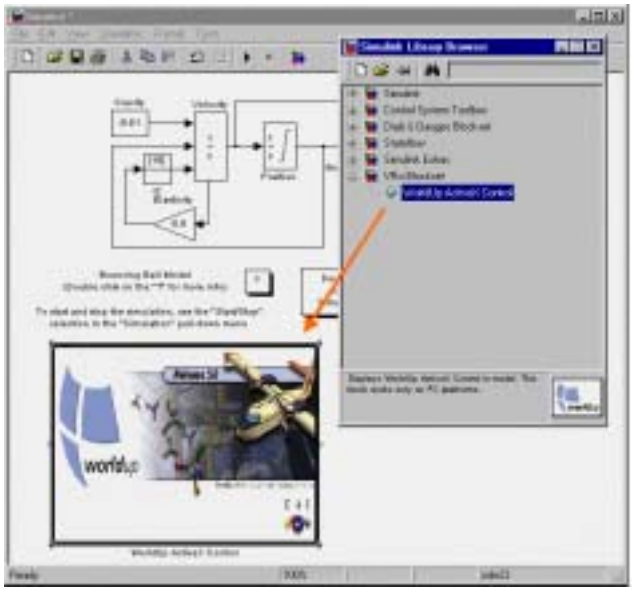


2) Insert the 3D Visualization Block into the Bounce Diagram

   a) Open the Library Browser window (*View -> Show Library Browser* from the Simulink main menu). You should see the "VRo Blockset" near the bottom of the tree. Expanding this blockset reveals the "WorldUp ActiveX Control" block

   b) Select and drag the "WorldUp ActiveX Control" block from the Simulink Library Browser window into the Bounce diagram window.

   c) Resize and position the WorldUp ActiveX Control block until you have it in a reasonable position.

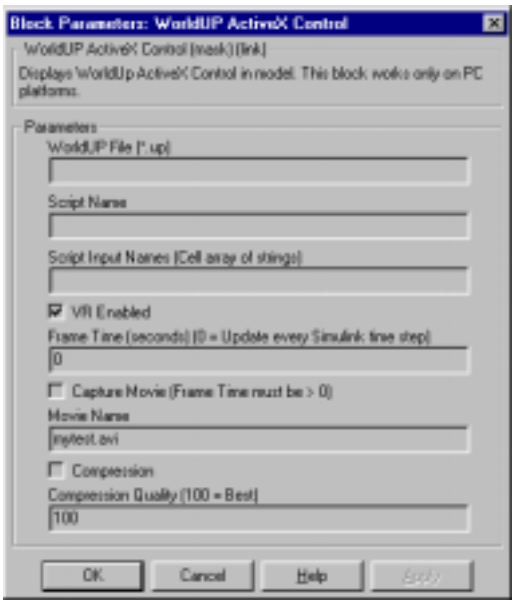


3) Insert your 3D scene into the visualization block

a) Double-click on the black border surrounding the WorldUp ActiveX Control block.

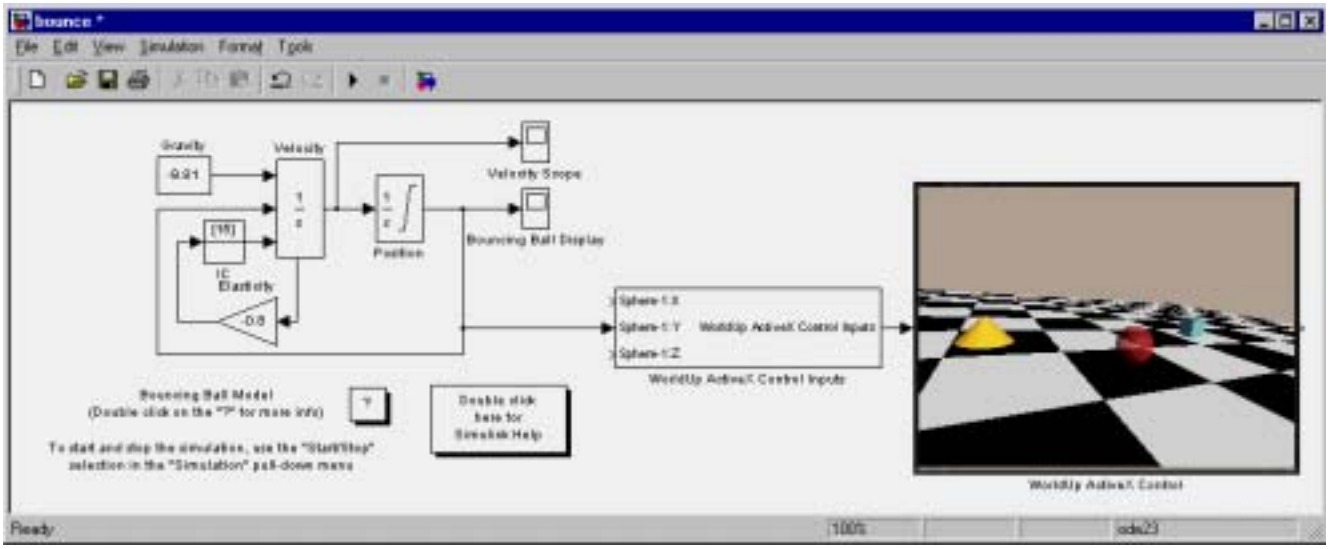
b) Type in the path to the ***world****up* project file (.up file) file you created in part 1. This loads the .up file into the 3D window and creates an input block representing the 'Translation' property you exposed from ***world****up.*

c) Drag the "WorldUp ActiveX Control Inputs" block, which is typically placed to the left of the Control block to a position so that you see it entirely. Something like below.



4) Connect your Visualization Scene to the Bounce Diagram

a) Connect **Sphere-1: Y** input to the output line of the Simulink Bounce model.



5) Test your Visualization

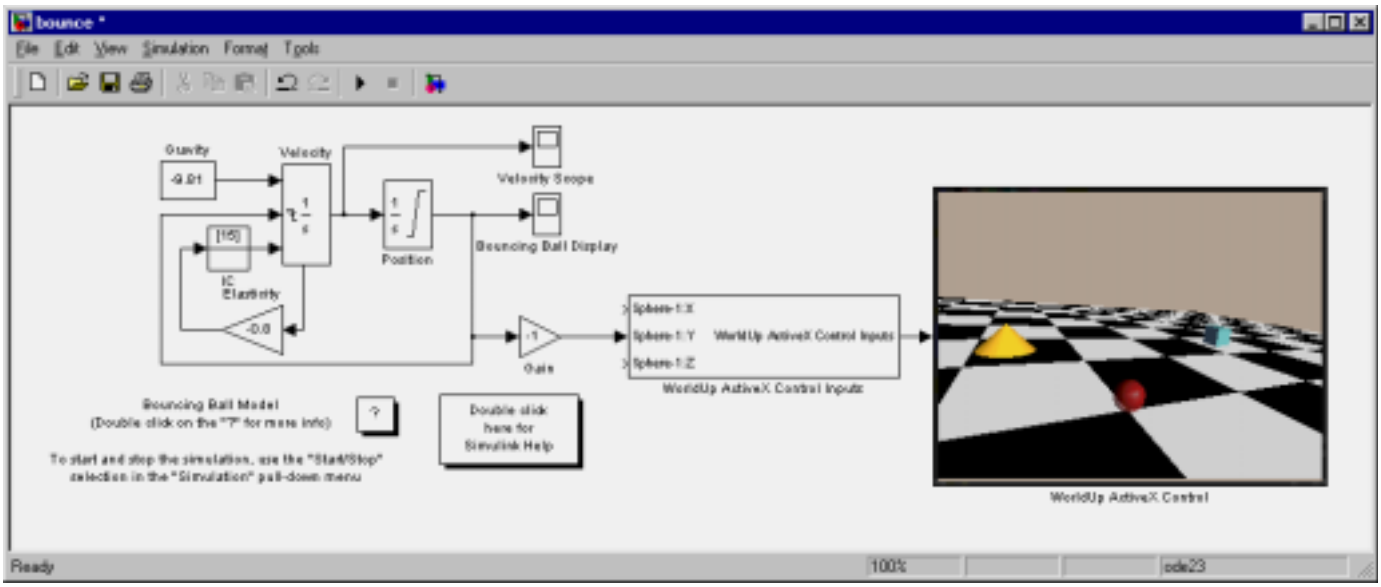
a) Start the Simulink Simulation. The ball does not seem to be bouncing correctly! It's not. It's bouncing upside down. Why? ***worldup*** considers +Y as down, and –Y as up. The fix? You got it, simply insert a negative Gain block.

6) **Edit your Visualization by Correcting the Vertical Inversion**

a) Insert a negative Gain block by dragging the Gain block (located under *Simulink -> Math -> Gain*) onto the line going into your **Sphere-1: Y** input.

b) Edit the Gain block by double clicking the Gain block and setting the 1 to a -1.

c) Your final Model should look like this:



Conclusion

Considering more brain matter is dedicated to visual information processing than all other senses combined, it is easy to see why 3D is well poised as a medium to take specific advantage of our advanced analytic processes.

While using an interactive 3D environment to convey the concept of a bouncing ball could certainly be construed as overkill, there are a plethora of real world simulations that present such voluminous multi-variant datasets to us as to defy comprehension. These complex, multifaceted simulations overload conventional human analysis strategies. In these situations, 3D can provide breakthrough understanding of complex systems that previously could not be contained within the human working memory. In addition, as evidenced in our simple bouncing ball tutorial, 3D provides an intuitive mapping medium that allows for quick and decisive design or behavior communication and validation.

To help you get started, you can fund a vast array of free models, textures, projects, source code, and other 3D simulation examples you can quickly use in your own simulations at ***www.3DRocketFuel.com***

For more information on ***worldup*** or any of the other visual tools and solutions offered by Sense8, please visit our website at ***www.sense8.com***, or contact a salesperson directly at 415-339-3223.