Controlling the Servo Motor with Algebraic Functions Algebra

Importance of Functions

Algebraic functions are operations that take input and produce output based on some algorithmic rule or process. Functions like these are used extensively in computer software to control not only the computer itself but other machines. Even in gaming systems, as a player manipulates the joy stick, input is being sent to the computer in the gaming console where functions output data to manipulate graphics on the screen.

Wireless Game Controllers
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As an example of controlling a machine by a computer we use Labview to operate the servo motor on the Function Plane. Servo motors like this are often used to position objects such as the rudder on a radio-controlled model airplane. They are also used in industrial applications and in robotics. Servo motors have 3 wires, one connected to a positive voltage, one for ground, and the third to control the motion. The Labview software on the computer can be used to send pulses through the control wire to an electronic circuit inside the motor's case. This electronic circuit measures the time duration of the pulses (called the pulse width) and moves the shaft of the motor to a corresponding angle position. Operating the servo by inputting a pulse width is not very convenient. To allow the user to enter input as an angle position matched to 50° to -50° paper overlay, the relationship between the pulse width 'w' and angle x1was determined and the function w= f2(x1) was created. Now that we have this function we can compose other functions with different input variables to control the servo by outputting an angle.

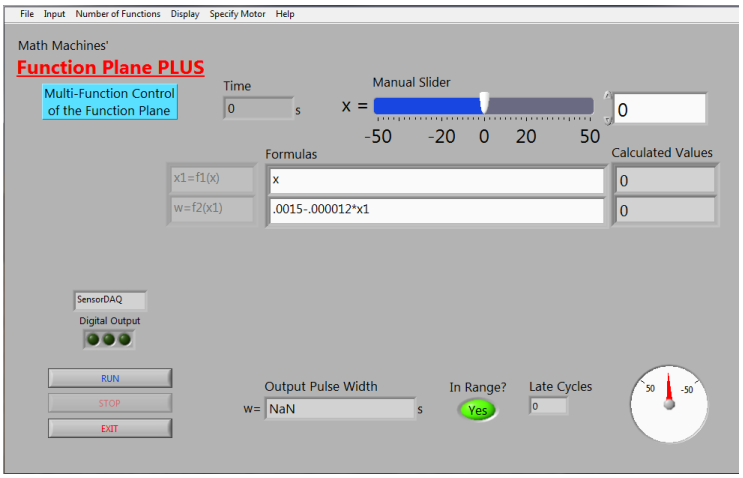
Task: Find functions to control the movement of a video game character attached to the Function Plane pointer.

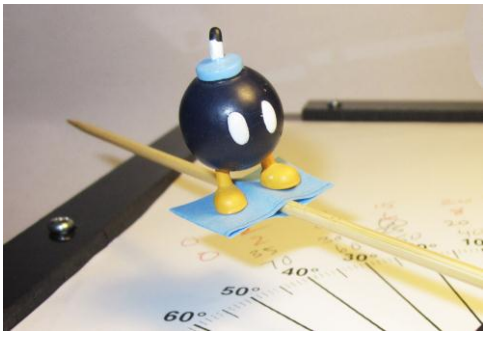
Additional Materials: 50° to -50° paper overlay, video game character.

Math Machines Program:

Function Plane Plus

Activity File: ServoAF001





1. Construct the function ‘x1’ so that as ‘x’ goes from -50 to 50 our servo character goes from:

   a. 50° to -50°. f1(x) = _____ Domain: _____ Range: _____

   b. 25° to -25°. f1(x) = _____ Domain: _____ Range: _____

   c. 50° to 0°. f1(x) = _____ Domain: _____ Range: _____

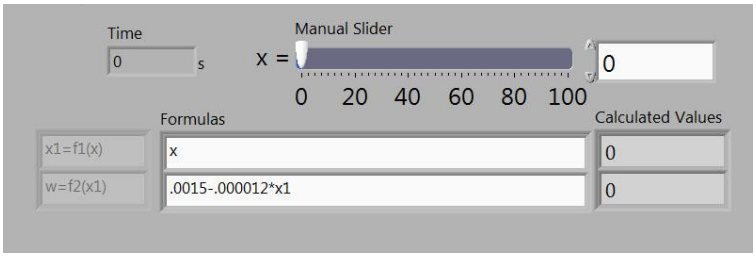
   d. -25° to 0°. f1(x) = _____ Domain: _____ Range: _____

   e. 40° to -10°. f1(x) = _____ Domain: _____ Range: _____

2. Construct the function ‘x1’ so that as ‘x’ goes from -10 to 10 our servo character goes from:

50° to -50°. f1(x) = _____ Domain: _____ Range: _____

For the next set of problems, set the slider domain values from 0 to 100 by typing over the -50 and 50.



3. Construct the function ‘x1’ so that as ‘x’ goes from 0 to 100 our servo character goes from:

a. -50° to 50° f1(x) = _____ Domain: _____ Range: _____

b. 50° to -50°. f1(x) = _____ Domain: _____ Range: _____

c. 0° to -30°. f1(x) = _____ Domain: _____ Range: _____

d. -10° to 10°. f1(x) = _____ Domain: _____ Range: _____

Now try this!

e. As x goes from 0 to 100 make the servo go from 50° to -50° and then back to 50° when x = 100.

f1(x) = _____ Domain: _____ Range: _____

4. Explain in your own words how functions x1=f1(x) and w=f2(x1) are working to control the servo.

