

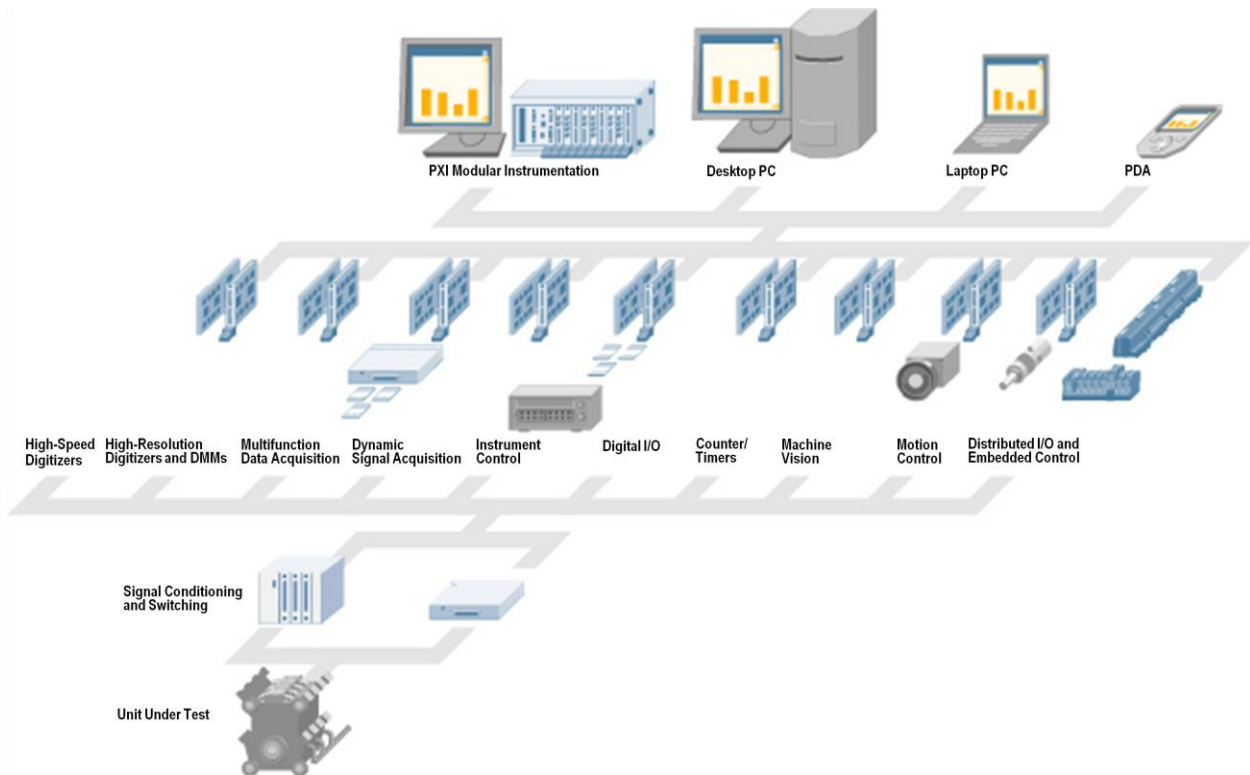
Mathematics for Engineers

Hands on Manual

By

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Exercise 1 – Roots of a Polynomial

Goal

Purpose of this exercise is to find roots of a polynomial both real and complex, separate real and complex roots from each other and draw the polynomial from minimum to maximum value of real roots.

Description

Use the Complex Polynomial Roots VI to solve for the roots in the following polynomial:

$$a_0 + a_1 X + a_2 X^2 + a_3 X^3 + \dots = 0.0$$

In this example, a real coefficient array is randomly generated or you can enter it manually. The Complex Polynomial Roots VI solves for the complex roots of the polynomial. The real and complex roots are then separated from each other. The polynomial is then plotted over an X range from minimum to maximum value of real roots.

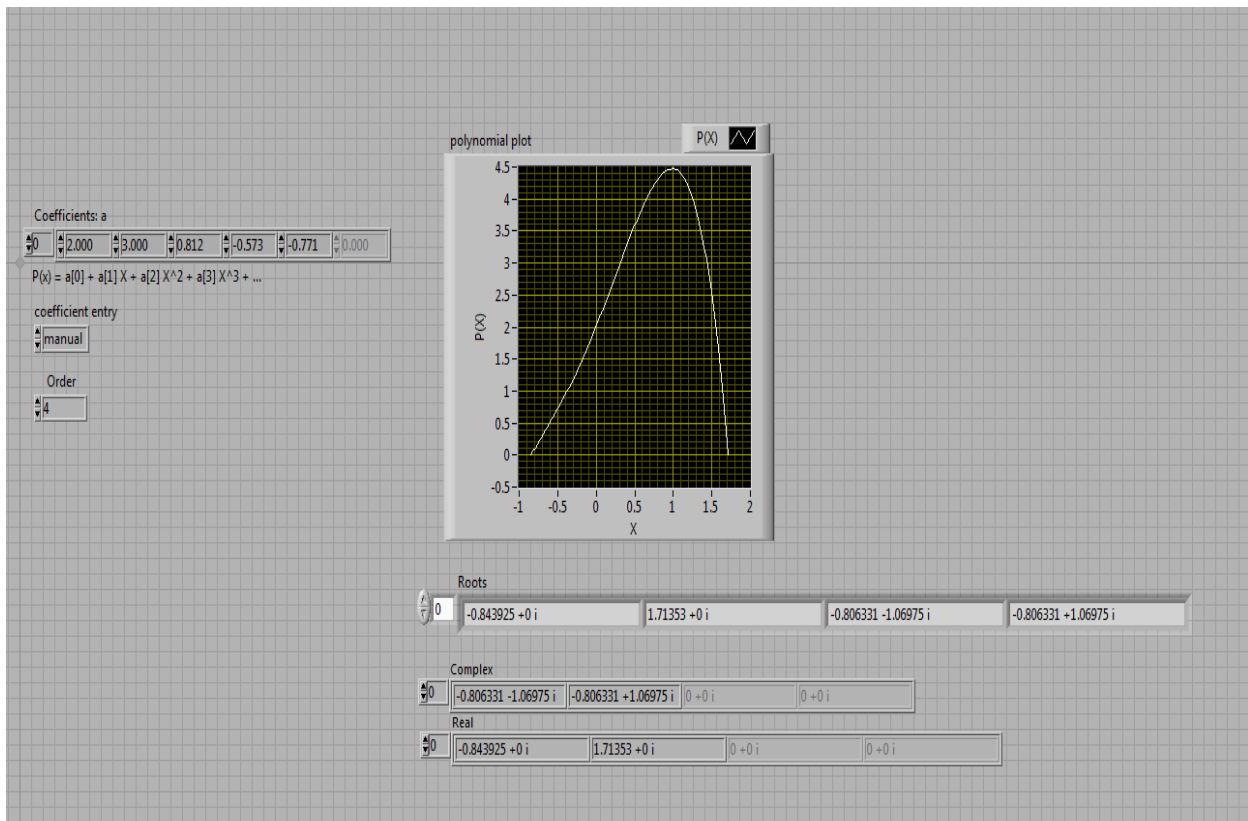


Figure 1

Exercise 2 – Introduction to Matrices and Linear Algebra

Goal

Purpose of this exercise is to implement some of the basic operations of matrices and solve a simple system by tools of linear algebra.

Description

Performs a variety of linear algebra operations, such as determinant, rank, product, transpose, eigen value on the matrix A, or in some cases, on the system of equations defined by $Ax = b$ to find out solution to the system.

In this exercise we will make one vector and one matrix for calculation purposes. We will also familiarize ourselves with while loops and tab control in labview.

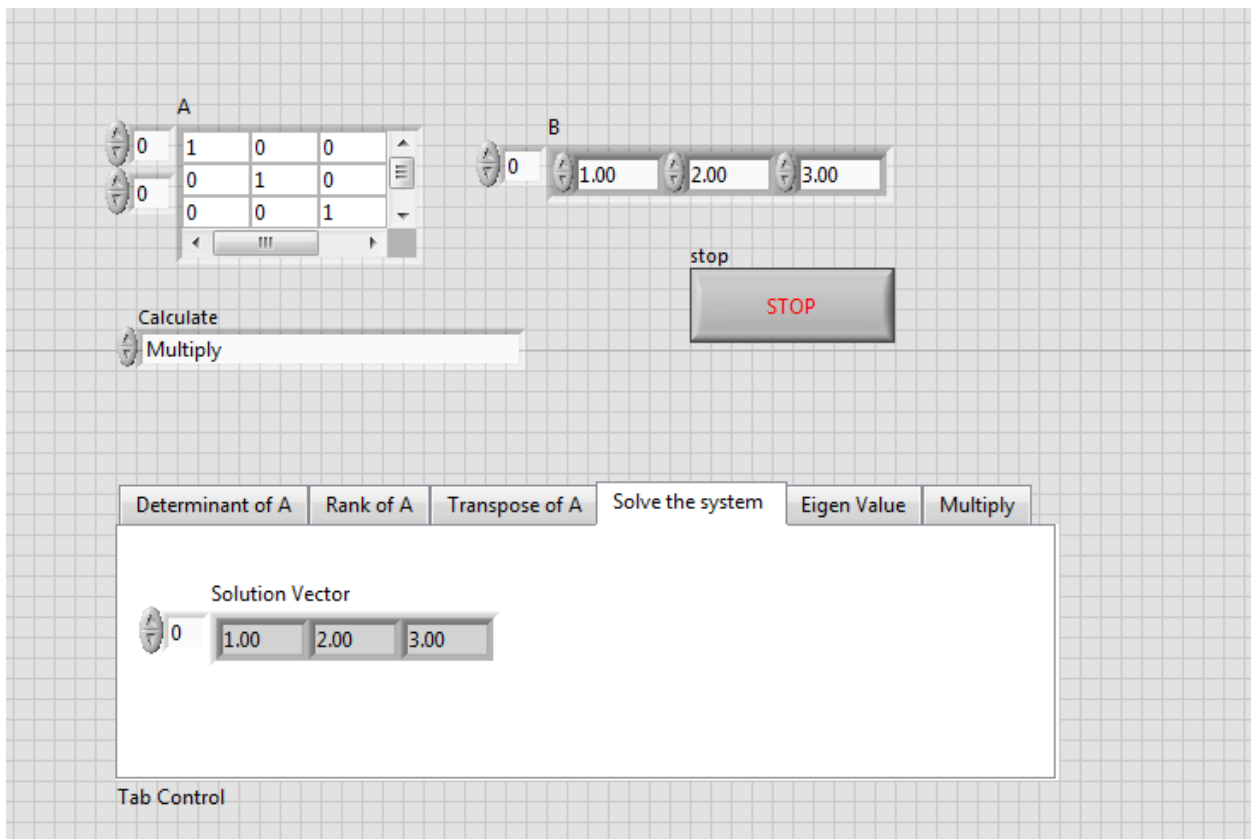


Figure 2

Exercise 3 – Voltage across the inductor by Differentiation

Goal

Given a current profile flowing through an inductor objective is to find voltage profile across it by differentiating the current profile.

Description

Voltage current relationship across the inductor is described by equation:

$$V = L \frac{dI}{dt}$$

In this exercise we will create a triangular wave representing current flowing through the inductor and then we will use the above given formula to calculate voltage across the inductor.

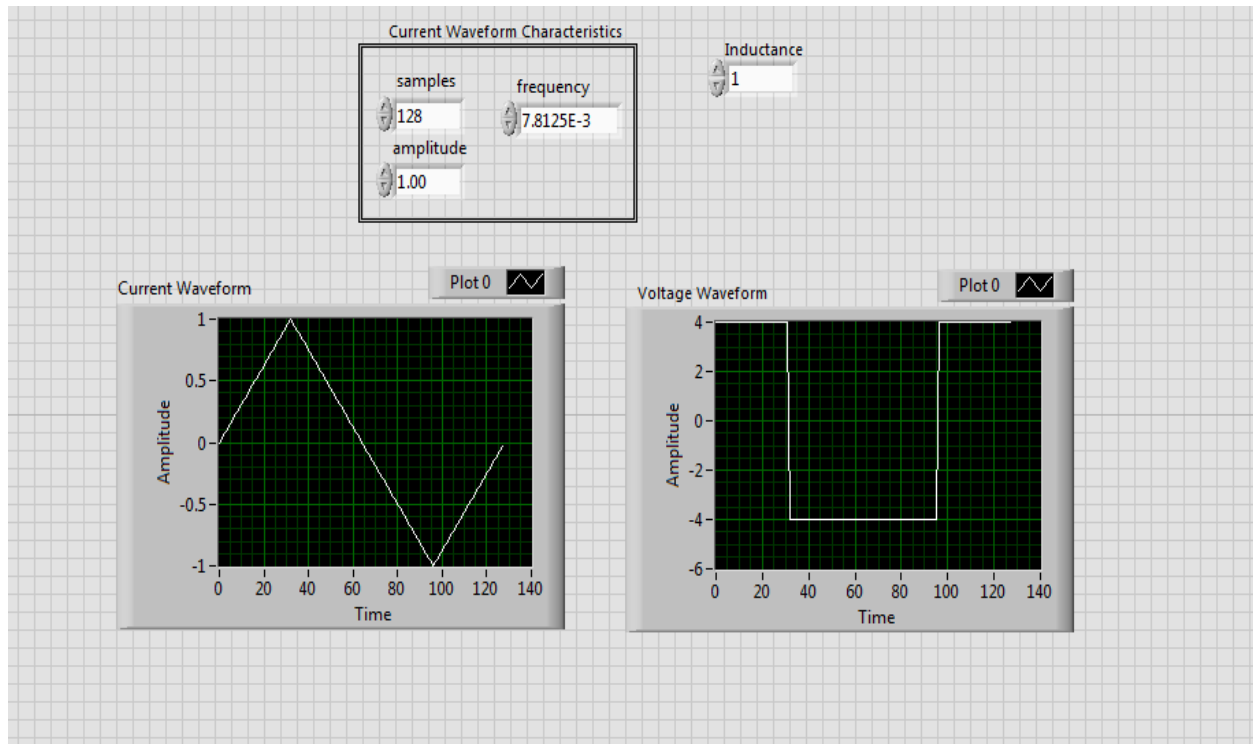


Figure 3

Exercise 4 – Point approach for differentiation in context of inductor

Goal

To study a point by point approach in differentiation keeping in view inductor circuit as Exercise 3.

Description

In this exercise we will make a user defined waveform and we will perform point by point analysis to find voltage across inductor by differentiating current flowing through the inductor. For this purpose we will use control and simulation loop which imparts timing information to simulation and calculation.

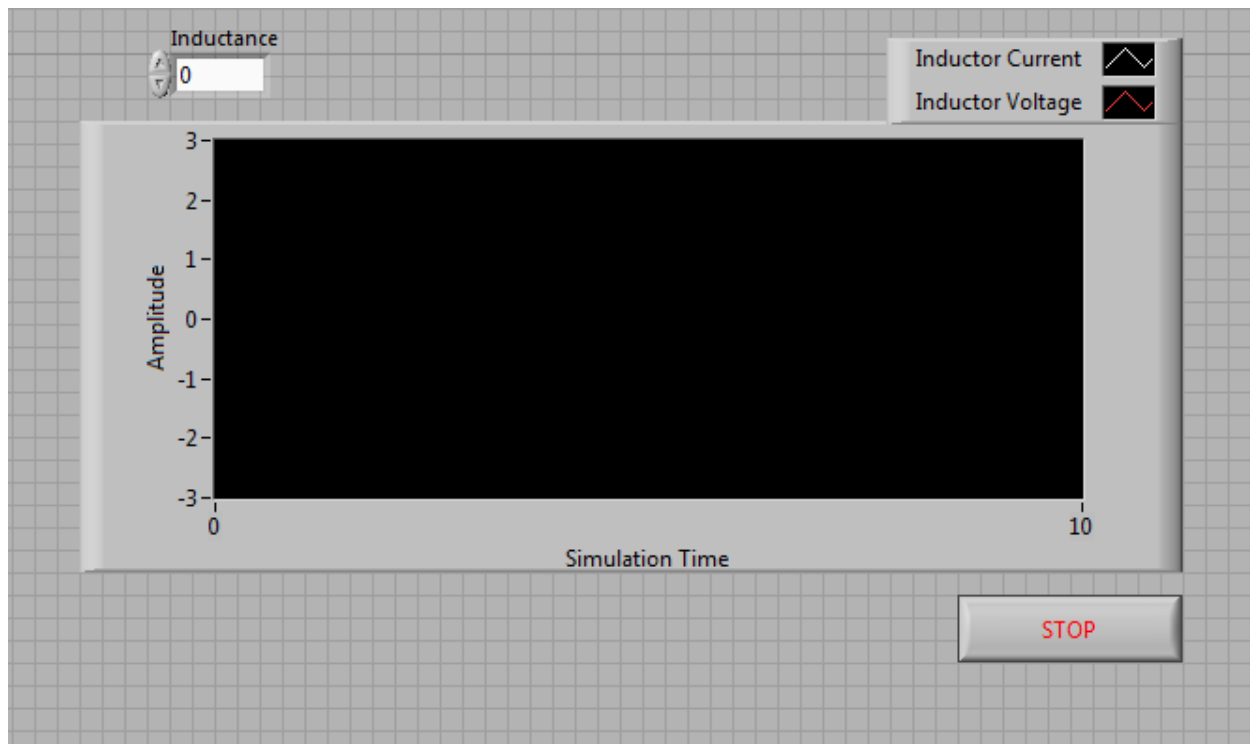


Figure 4

Exercise 5 – Charge Profile and Total Charge Accumulation in Capacitor

Goal

Purpose of this exercise is to find total charge accumulated and its profile in capacitor given that we have a current profile.

Description

In this exercise we will generate a current profile represented by a square wave and then we will calculate both the definite and indefinite integral to find out charge profile and net charge accumulated during the flow of current through the capacitor.

$$Q = \int I dt$$

In this example we have assumed that before the flow of current the capacitor was uncharged.

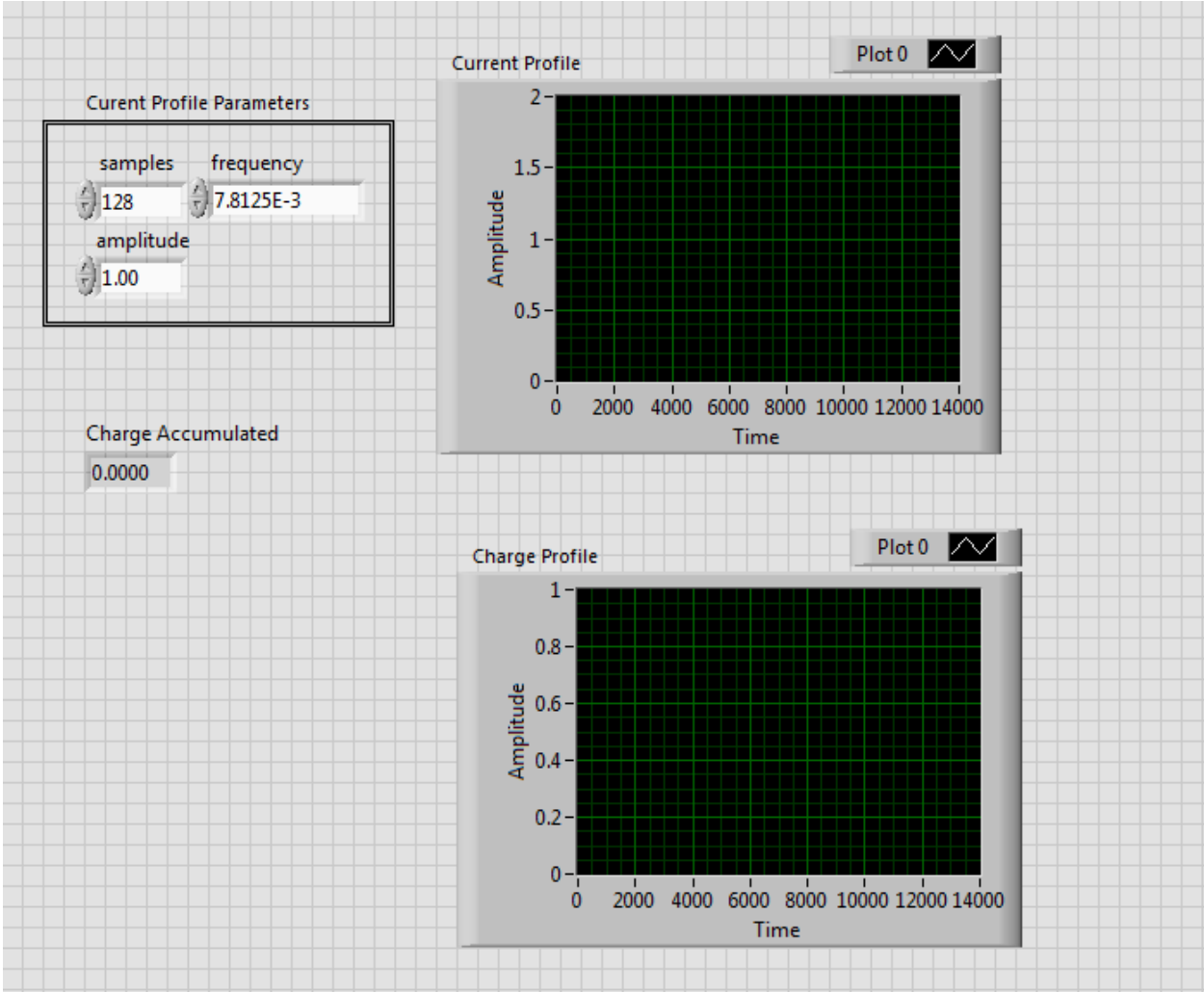


Figure 5

Exercise 6 – Currents in RL Circuit by the use of Differential Equations

Goal

Purpose of this exercise is to learn to solve Ordinary Differential Equations in Labview and apply this technique for solving circuits.

Description

This example demonstrates how to use the polymorphic ODE solver in VI mode. Note that VI mode allows for setting constant values via front panel controls, and the formula is passed by reference from a separate VI (CircuitRHS.vi). CircuitRHS.vi contains the formula in LabVIEW code of the Circuit ODE system model:

$$di_2/dt = (-(R_1+R_2)i_2 - R_1i_3 + V_{in})/L_1$$

$$di_3/dt = (-R_1i_2 - R_1i_3 + V_{in})/L_2$$

See the circuit diagram on the front panel of this VI which is given below.

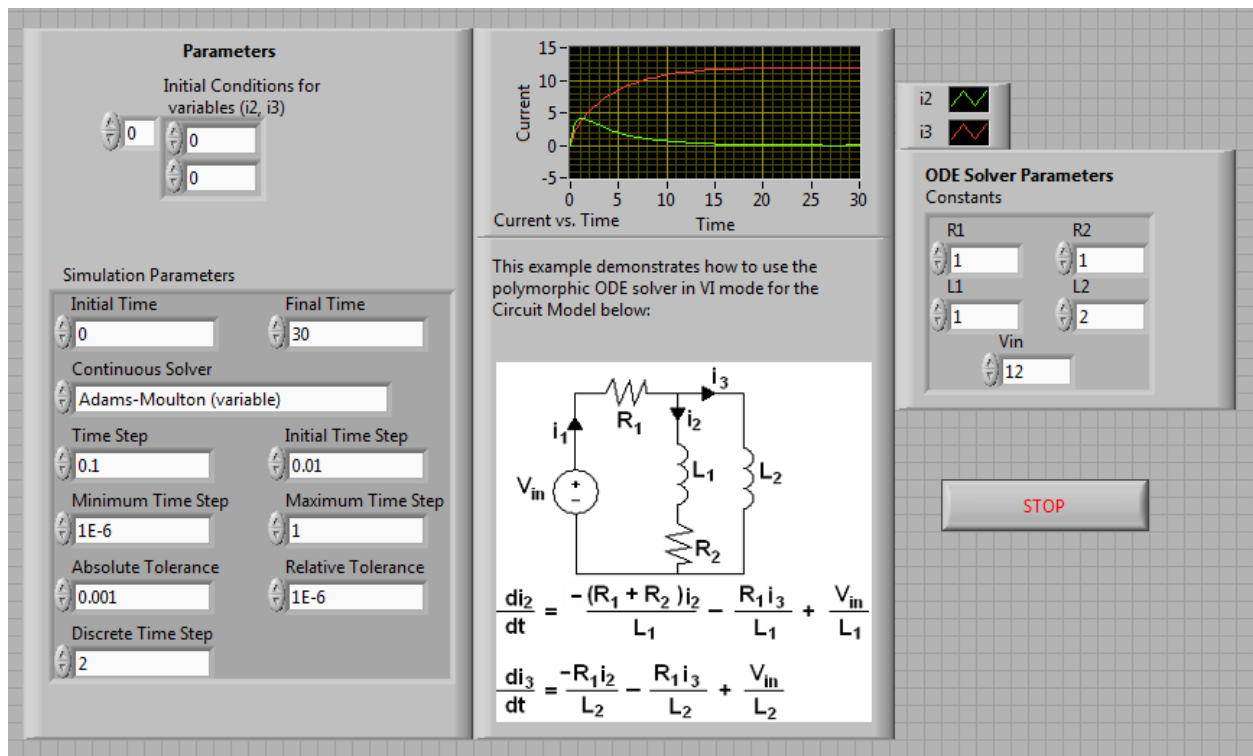


Figure 6

Exercise 7 – Notch Filtration by Difference equation

Goal

Learn implementation of difference equation in Labview and apply this concept to do filtration of a particular frequency in system. Also familiarize ourselves with Mathscript node in labview.

Description

In this exercise we will generate a sinusoidal signal. Then we will do its analysis in discrete domain and apply a suitable filter so that signal is filtered out. In order to make a notch filter in discrete domain following difference equation is used:

$$y[n] = x[n] - 2 \cos(\omega)x[n - 1] + x[n - 2]$$

In this equation 'w' represent the discrete time frequency which is to be filtered out.

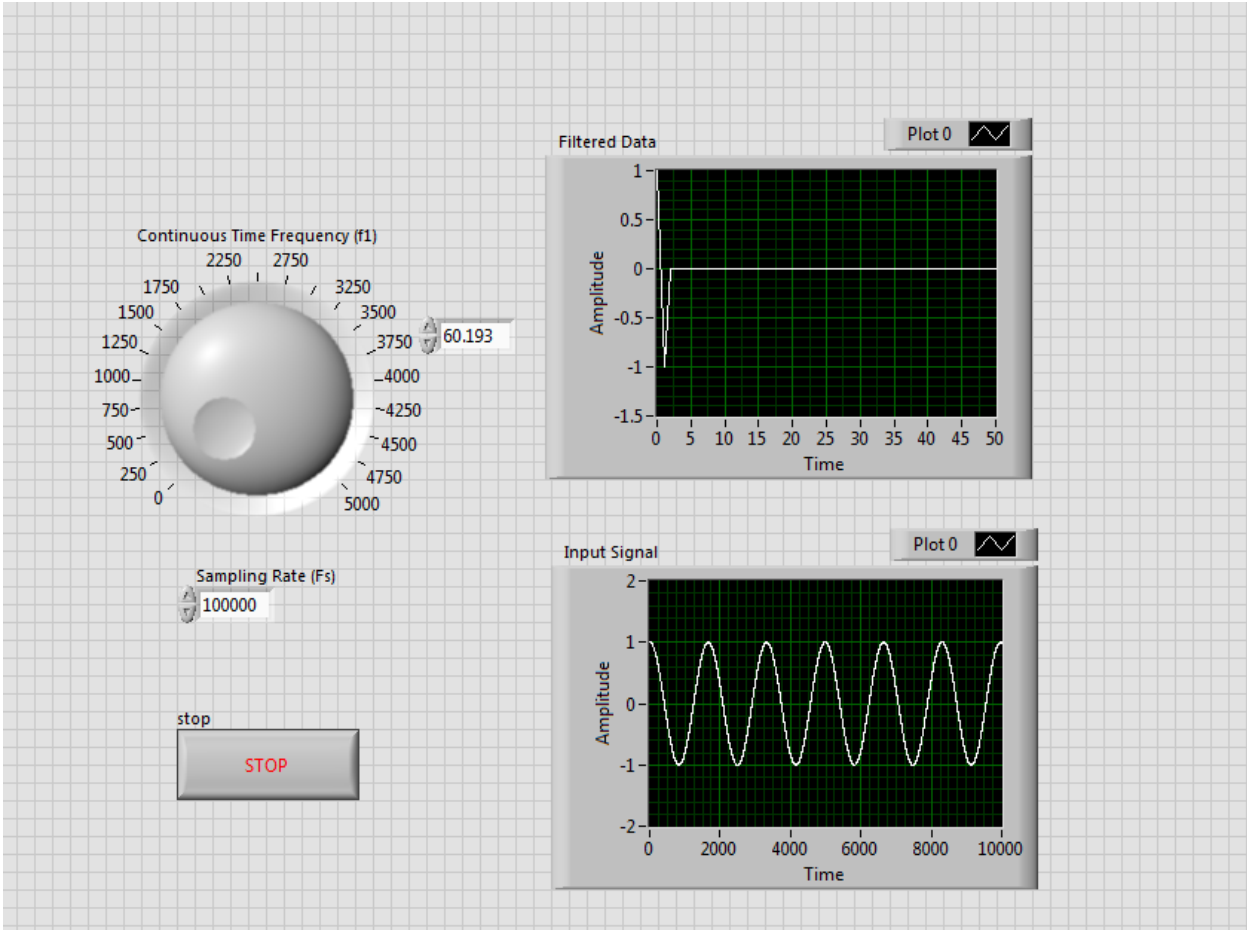


Figure 7