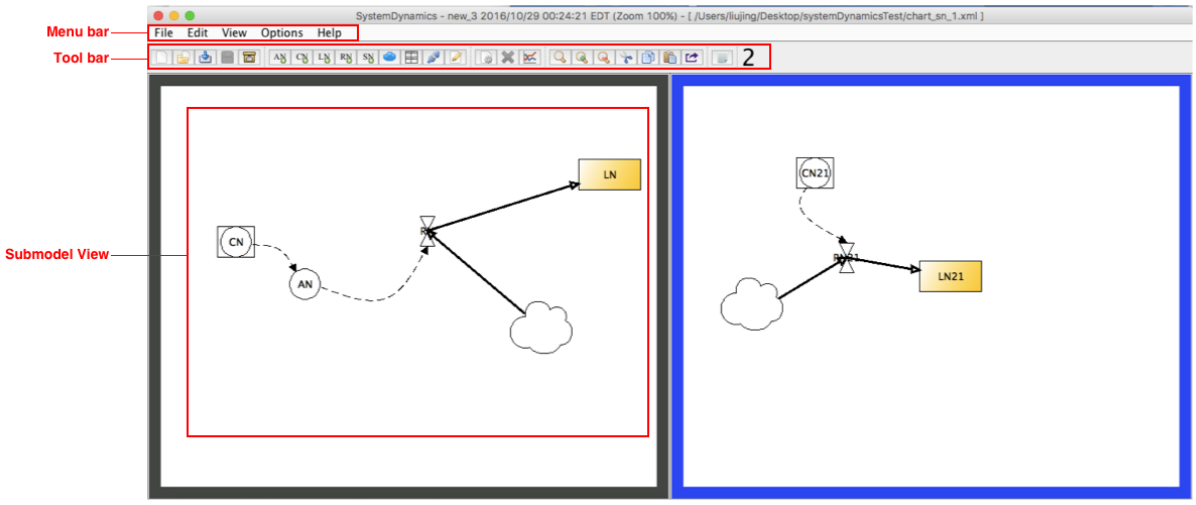
System Dynamic Simulation Builder documentation

Tool Introduction

The interface is divided into three parts: Menu Bar, Tool Bar and Sub Model View.

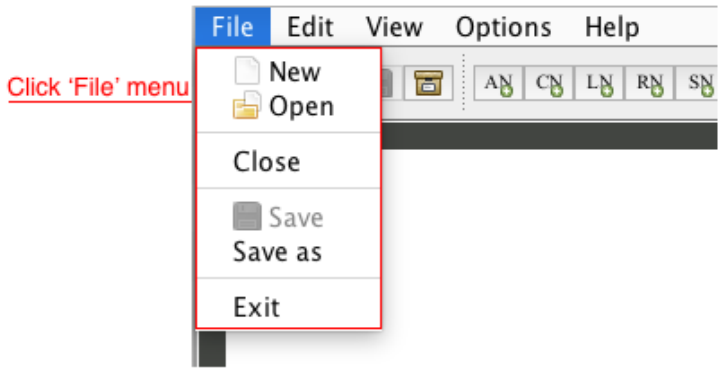


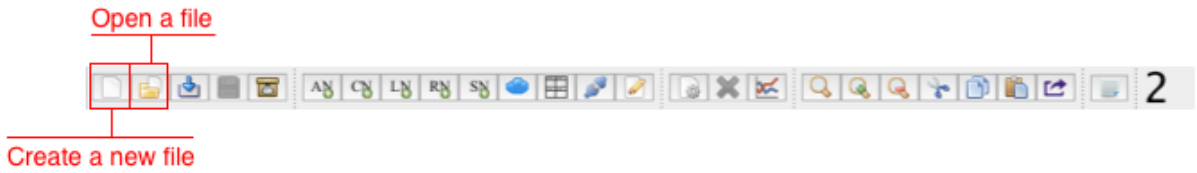
With the simulation tool, users can create and edit a model, run simulation in execution mode and create chart designer file.

Create/Edit a model

Create/Open a file

To create a model, users can either create a new file or open an existing file by clicking ‘File’ on Menu Bar or corresponding icons on the Tool Bar.





After creating a new file, a sub model is created automatically in the Model View. Users can add nodes to the model.

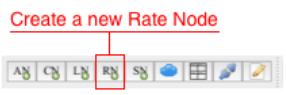
Create Nodes

Nodes used in the model include Auxiliary Node, Constant Node, Level Node, Rate Node and Source Node.

Source Node(SN)
Source Node is a starting point of the whole graph.

Constant Node(CN)
Constant Node represents a constant used in a formula. Its value cannot be changed during the simulation execution.

Auxiliary Node(AN)
Auxiliary Node represents a formula which can be reused by multiple Rate Node.



Rate Node(RN)
Rate Node contains a formula which can use the value from Constant Node, Auxiliary Node, Level Node and Shared Node. It is the only node which can be connected to a Level Node using a flow.

Level Node(LN)
Level Node represents the variable users want to simulate the trend for.

After creating the nodes, we can add/edit formula to AN or RN and add flows between RN and LN.

Edit Nodes

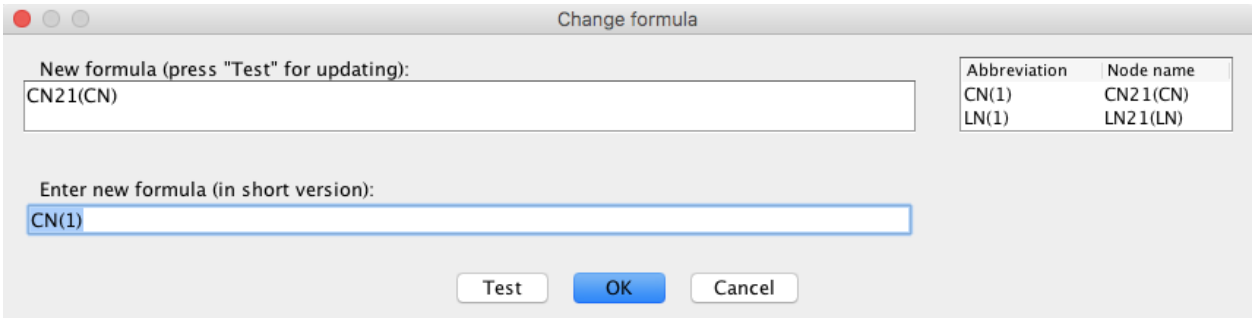
To edit a node, right click on the node, a temporary view will show what you can change on the node.

Formula

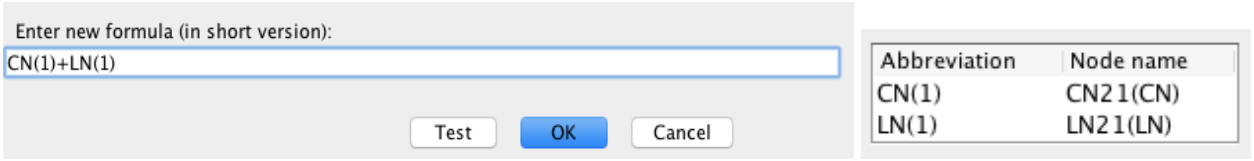
Formula only exist in AN and RN. Operations include addition, subtraction, multiplication and division.

Step 1: Right click on AN or RN

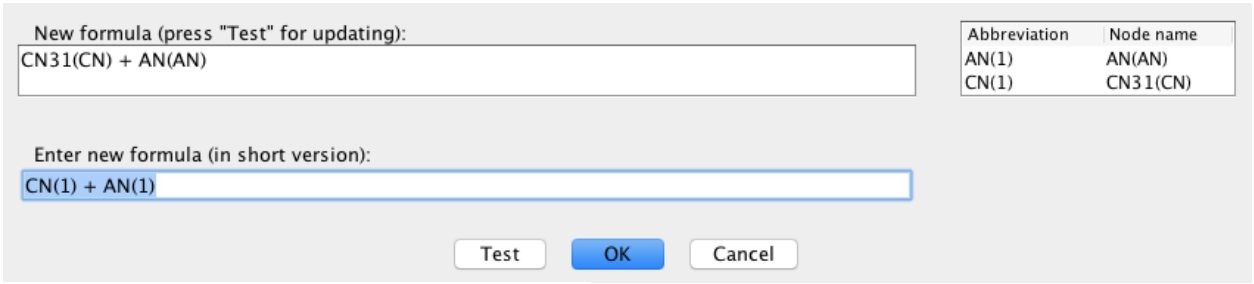
Step 2: Click ‘Change formula’

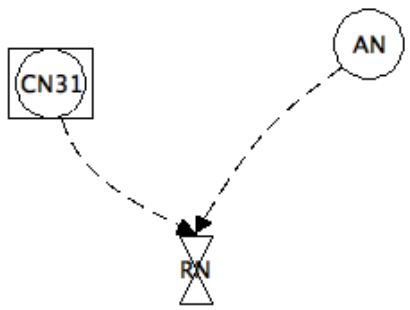


Step 3: Input the new formula using Abbreviation of node and operations we provide



Once a formula is added, a dashed arrow is drawn on the graph to show the value of RN/AN depends on nodes used in its formula

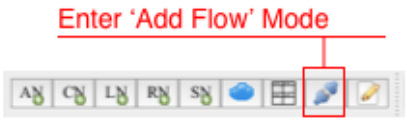




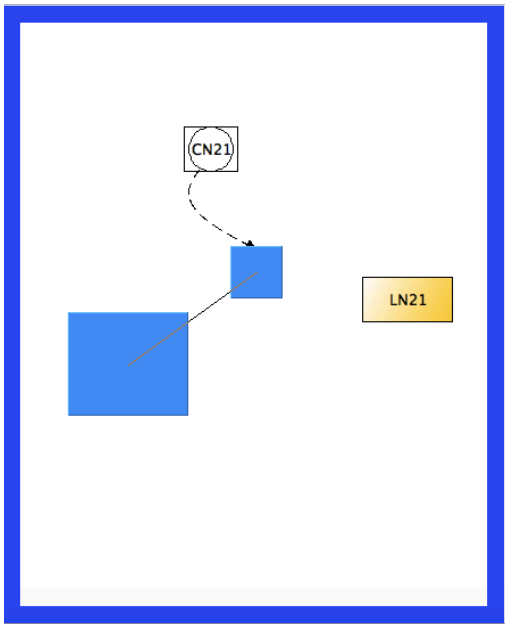
Flow

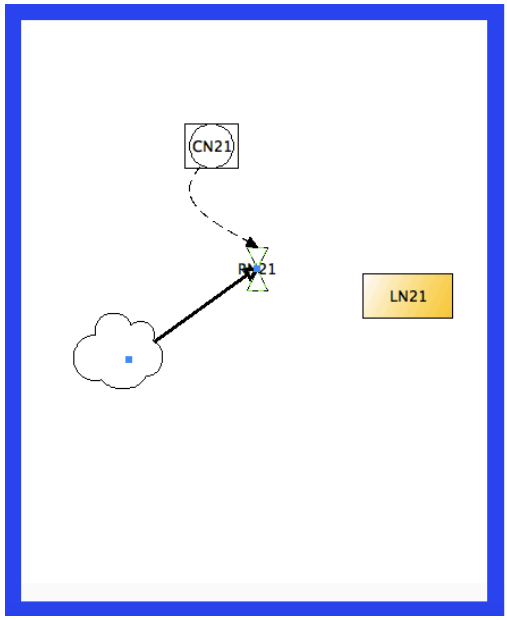
Flows can only be added between RN and SN or RN and LN.
Flows pointed from a RN to a LN means to add the value of RN to the current value of LN. Flows in reverse direction means to subtract the value of RN from LN.

Step 1: Click 'Enter Add Flow Mode' icon on the tool bar

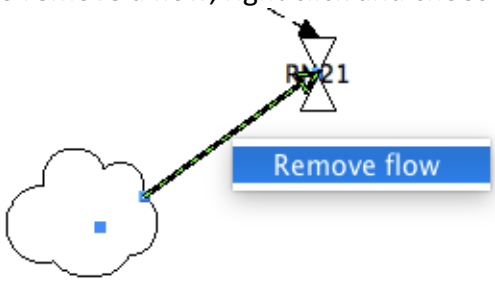


Step 2: Click and drag from a node to another, a solid arrow denotes the flow



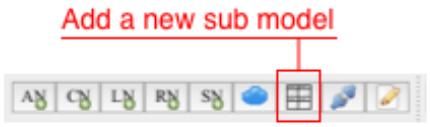


To remove a flow, right click and choose 'remove flow' menu.



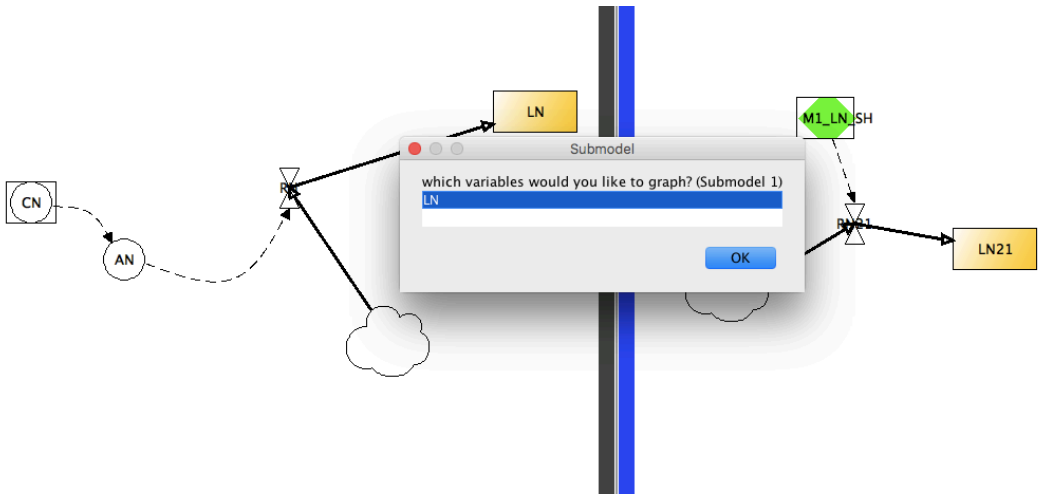
Add another sub model

You can have multiple models in one xml file by clicking ‘add sub model’ icon on the tool bar.

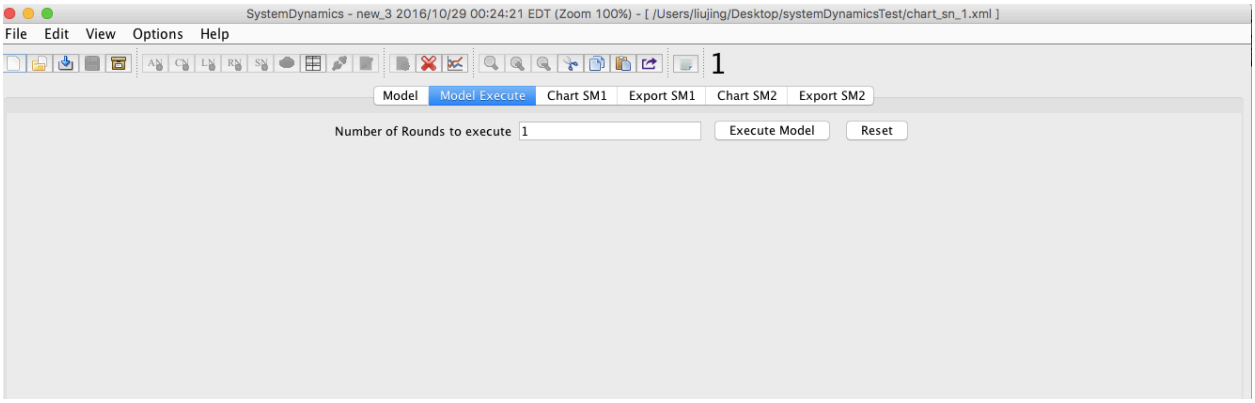


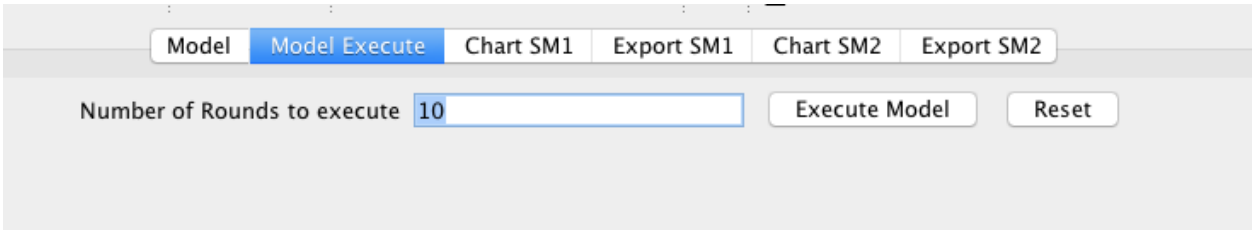
Simulate Level Node in Execution Mode

Step 1: Click on ‘Execute Model’ tool on the tool bar, save the current model file, choose which variable to graph in each sub model

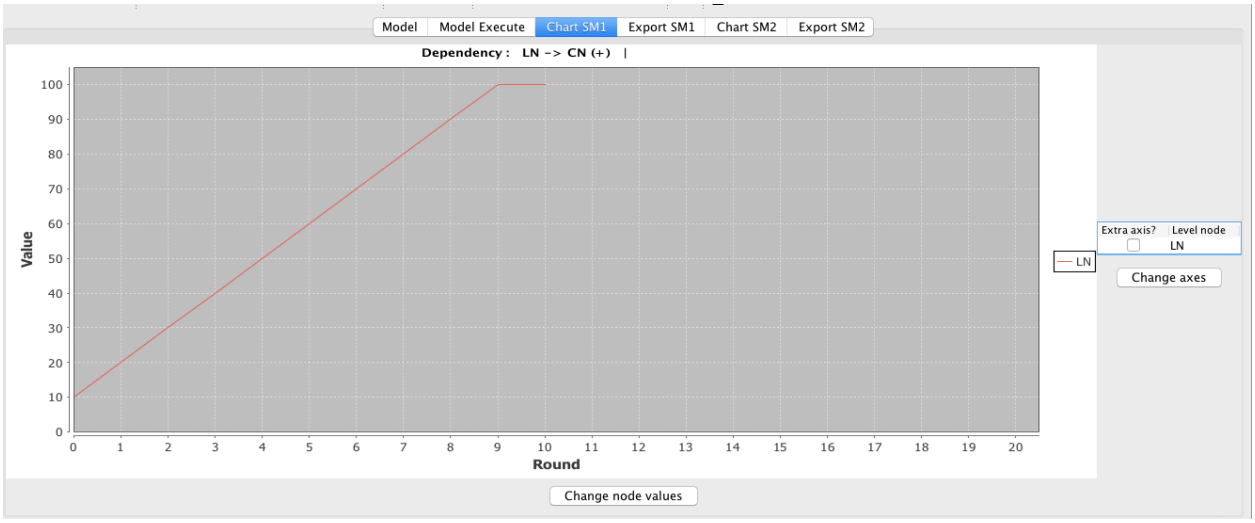


Step 2: In the new ‘Model Execute’ view, input the number of rounds you want to execute and click ‘Execute Model’ button. You can also use the ‘Reset’ button to clear all the simulation data.

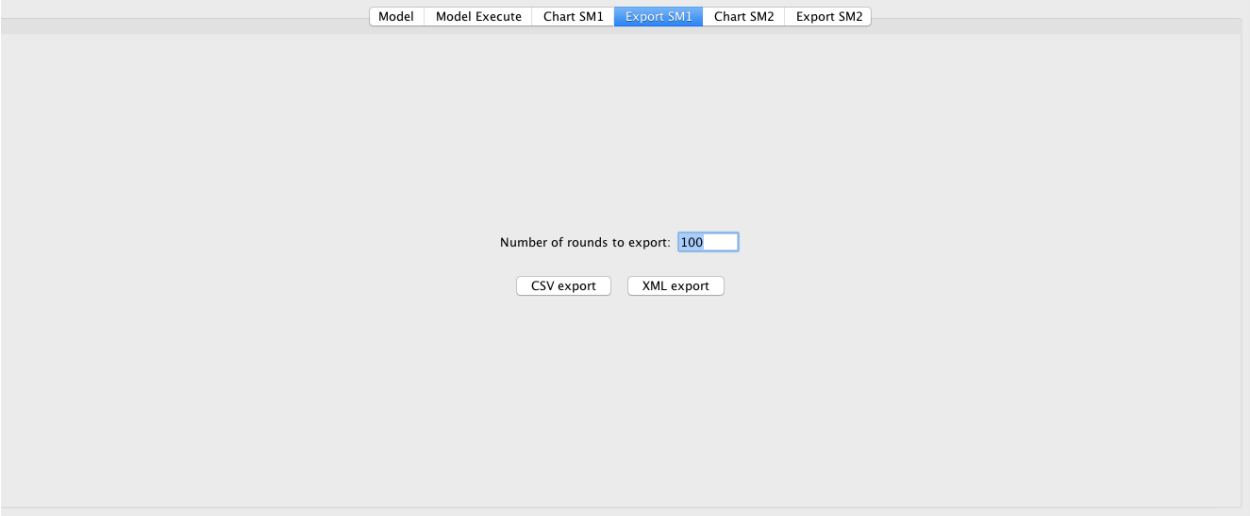




Step 3: Switch to ‘Chart SM1’ view to see the simulation graph

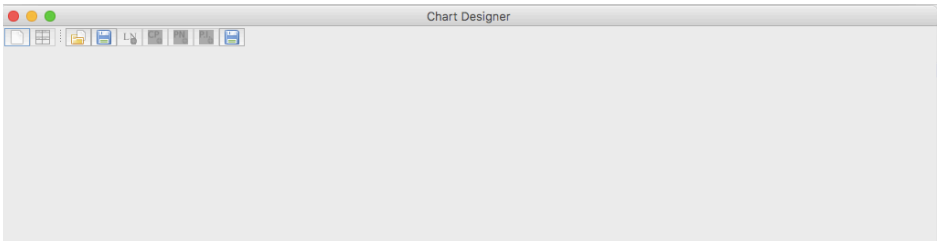


Step 4: To export the simulation results, switch to ‘Export SM1’ view, and choose either csv or xml file for export.

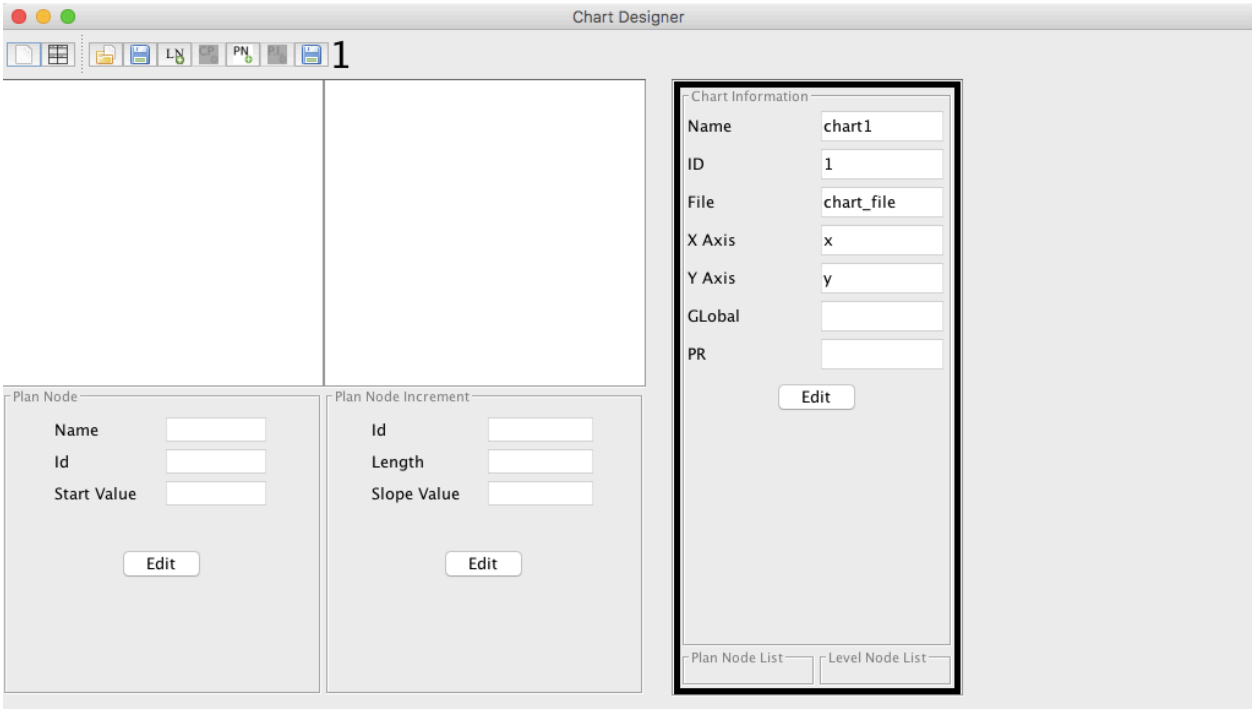


Create Chart Designer File

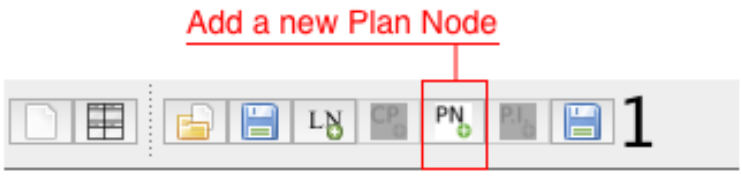
Step 1: To create a chart designer file, open the Chart Designer view first by clicking on the ‘Enter Chart Designer’ tool on the Tool Bar.



Step 2: Create a new Chart Designer file, input chart name, ID, file name, x axis, y axis, global variables and PR(optional).



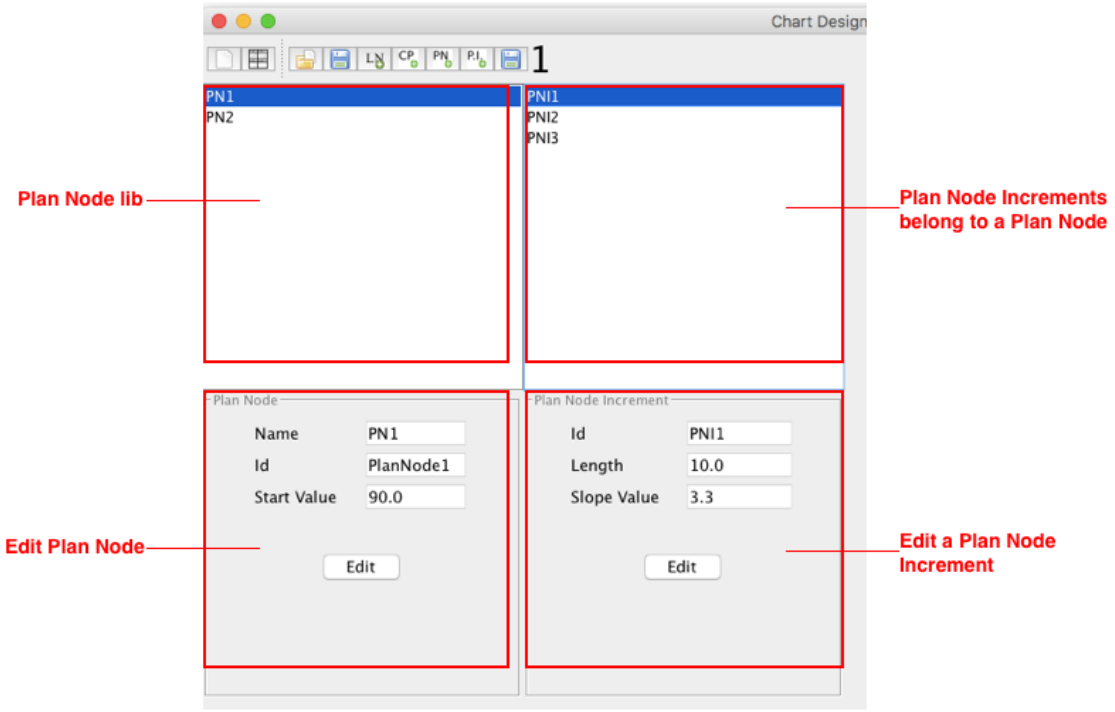
Step 3: Add Plan Node to the Plan Node library, each Plan Node consists of multiple Plan Node Increment.



Users can also edit the Plan Node by clicking on the node in the library list and click ‘Edit’ button below.

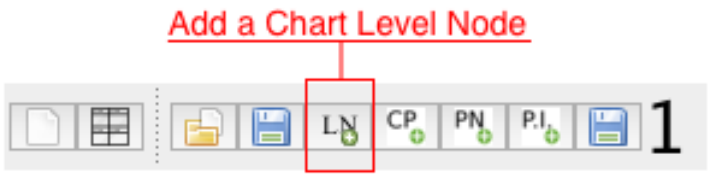
Step 4: Add Plan Node Increment to the Plan Node Node, each Plan Node Increment only belongs to one Plan Node.

Users can also edit the Plan Node Increment by clicking on the Increment and click ‘Edit’ button below.

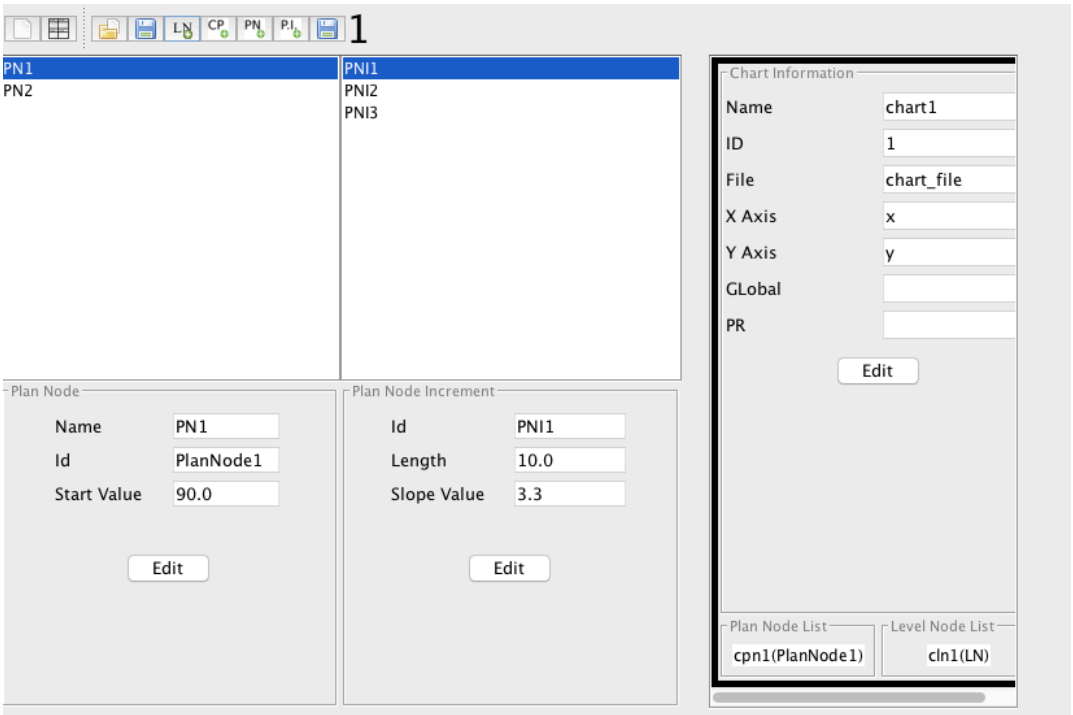


Step 5: Add a Plan Node from the Plan Node library to a specific chart on the right. The newly added node is called a Chart Plan Node.

Step 6: Add a Level Node defined in the model file to a specific chart on the right. The newly added node is called a Chart Level Node.



Users can view what plan nodes and level nodes a chart has in the list view on the right.



Step 7: Save the chart designer file by clicking on the ‘Save Chart’ icon on the tool bar.

Functional Changes

Functional Changes Made to System Dynamics

1. Add 'Description' attribute to Sub Model in model xml file
2. Change the structure of model xsd file
    a. Add 'ASTSharedNode' Types
    b. The new file is model1_new.xsd, the old one is model1.xsd
3. Add SharedNode
    a. Allow the use of SharedNode in the formula
    b. Allow read and write of SharedNode in the model xml file
4. Redesign ChartDesigner interface
5. Add Dependency of LevelNode on top of execution chart
6. Add 'Reset' function to Execution Mode
7. Modify 'Change Start Value' function in execution mode, add a new simulation chart if the start value is changed

Functional Changes Made to System Dynamics Command Line

1. Allow customization of chart designer file by appending '-g filename' to the command, or it will use a default file called 'chart.xml'
2. Change the structure of input file
    a. Add sub model ID before each variable
    i.e. 'LN1' in Sub model 1 should be written as 'SM1:LN1'
3. Change the structure of ouput file
    a. Show all the variables in all sub models in the header
    b. Add sub model ID before the name of variables like input file
4. Add new commands to global file
    a. VAR, VAR1+VAR2
        i.e. SM1:LN, SM1:LN+SM2:LN21
    b. VAR, VAR1-VAR2
        i.e. SM1:LN, SM1:LN-SM2:LN21
    c. VAR, VAR1*VAR2
        i.e. SM1:LN, SM1:LN*SM2:LN21
    d. VAR, VAR1/VAR2
        i.e. SM1:LN, SM1:LN/SM2:LN21
    e. VAR, IF(VAR1/CONST < VAR2/CONST; VAR3/CONST ; VAR4/CONST)
        i.e. SM1:LN, IF(SM2:LN21 < 17; 30 ; SM1:LN)

Introduction to Command Line

java -jar SystemDynamicsCommandLine.jar -m chart_sn_1.xml -r 180 -t csv -o output -h input.txt -c 0 3

- SystemDynamicsCommandLine.jar is name of jar file used
- -m ‘filename’
  - the name of model file created by sim builder
- -r 180
  - the number of rounds
- -t csv
  - the type of file for output, either ‘csv’ or ‘xml’
- -o ‘filename’
  - the name of output file
- -h ‘filename’
  - the name of input file
- -c 0 3
  - 0 means run the command for the first time in phase 3