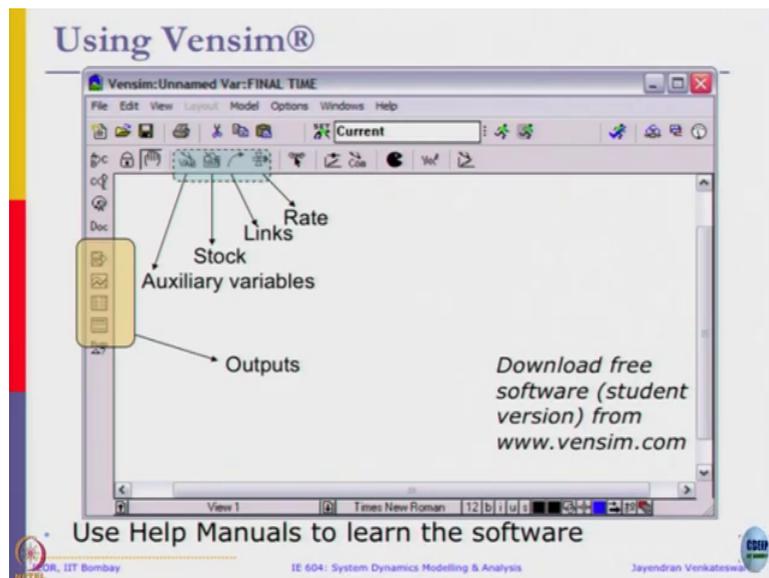**Introduction to System Dynamics Modeling**
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**Indian Institute of Technology, Bombay**

**Dynamics of Simple Structures Positive Feedback**
**Lecture – 7.3**
**Introduction to Modeling using Vensim software**

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I can briefly introduce you to Vensim. Vensim is a software we can use to simulate system dynamic models. If we put the underlying equation and click the run icon ones here the running it run the simulation. If you do not put the equations you can still draw some nice diagrams; like you know causal loop diagram etcetera it had a nice arrows etcetera you can help you do that.

This is one of the most simplest interfaces I have seen; though there are many icons, the icons of interest are what is highlighted there. So, there is a fourth icons from the left 1, 2, 3 forget

it nothing it is just lock screen this is just a move things around. This one which has a pencil and the and alphabets Var I think Va,r we use it to define auxiliary variable.

And there is a pencil with a rectangle which Var written that is to create a stock and then one arrow link to create a link that is a casual link. And a double headed arrow with a valve symbol that you guess a what we have been using, the same thing is use to define a rate link. That is exactly what we need we do not need anything else all other things are for just visualizing deleting and things like that this is like the (Refer Time: 01:35) to delete so not needed.

So, this is the entire thing you will ever be using for building models. Apart from Vensim there are other software's like I think Powersim software name is I think not thinking I think Powersim any logic etcetera. So, the symbols maybe slightly different but you just look for the user variable rate, some may use a rate term flow rate, some may use a term level instead of stock. But usually they have a symbol come on rectangle how there are so many ways only you can draw a rectangle.

So, we will have that or double headed arrow roughly be the same with a valve symbol maybe they get more graphic with the symbol of the valve but thinking much this one. And once you simulate you will be using the icons on a left side to visualize the output you just click the variable click that graph symbol you will get a graph immediately.

And if you so, these first two are for the graphs; then next two are for actually seeing the values that was simulated. So, once we get the actual values we can see and understand what is the computation happening or sometimes you will get that simulation; because this is just numerical integration nothing else it is just numerical integration. So, sometimes it will say out of bounce or value is too high or value crosses 0.

So, then you can actually see the numbers and see where it happened and what is happening and things that or you can copy it into excel to get better graphs out of system ah. So, then the free software the student version is free, you can download it from Vensim dot com you have to go register yourself give your email ID they will send you link then download the software

yeah. So, we will be using this in the in this course yeah this is the Vensim interface you click downloads and because free downloads are.

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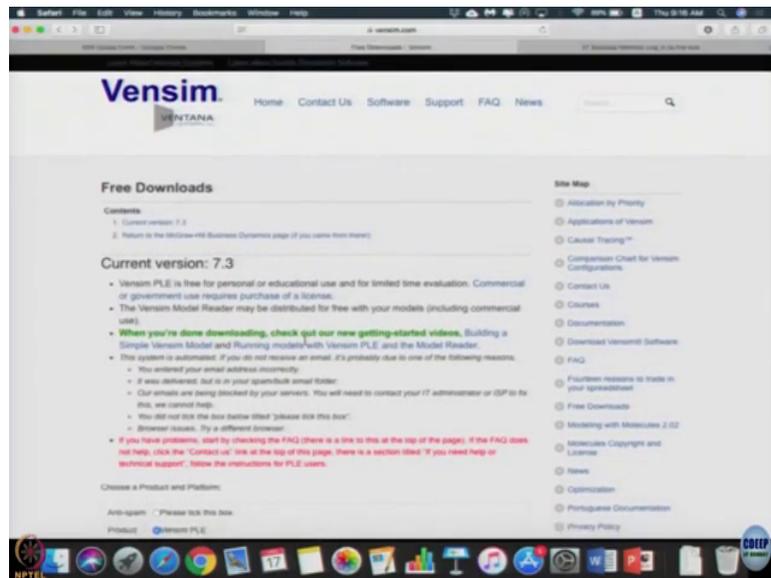


Go for the Vensim PLE it works only on windows and Mac it is a your Linux laptop install mine it work fine in mine no problem. Yeah, you just fill the details click download it in the software. And that sufficient for our course purposes its like I download a slightly new one.

So, here already its different from the picture I showed in the slide and I apologies for that explicits says variable level, arrow, rate, better symbols. So, we will just go with that simulate is the play button here and left side these are all the images looks like the picture is of a older version of Vensim; so, this is more clearer.

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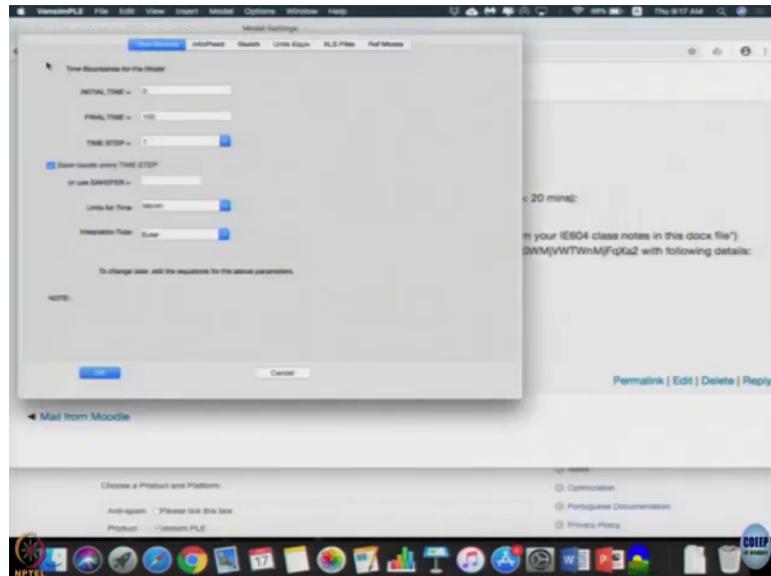


So, the first we do is a when we create a new model; the only thing it has a initial time final time, time step and what is the general time units that we are looking at? Let us say we are going to model this interest rate example. So, we want to keep this a time units as here; once a time step has 1 final time there it was 15. So, let us I am always take it a 20 time units to the time step of 1 this is if get just a blank screen. So, we had one rate, one flow, say same thing one rate, one stock can auxiliary variable.
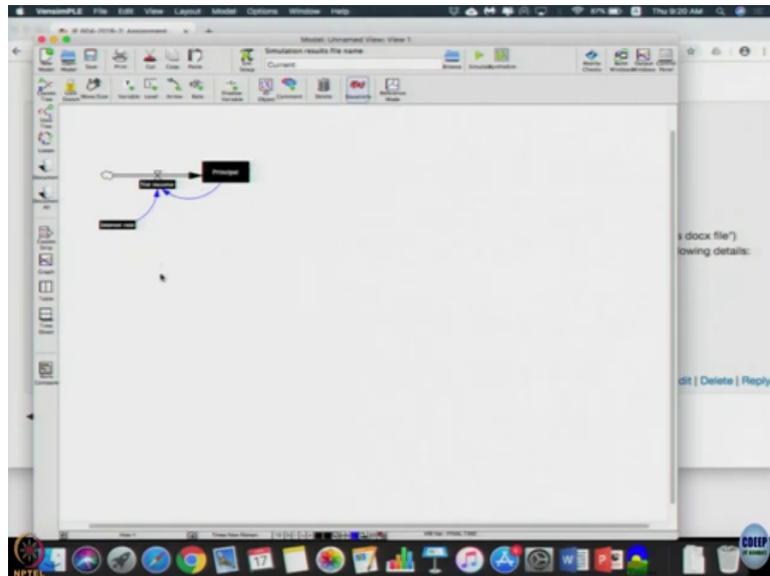
So, first always put the stock its easier I will tell you why and then you put a rate. Solid it was I did not draw anything I just click this somewhere and just wrote the name it get the rectangular there is no the right click left click this one click.

And then you click rate, then you click we wanted to go the directions. So, start point to end point start is outside the system; it clicks somewhere there is no I am not clicking and dragging. Then we just move it and somewhere inside this stock again make one more click, then it will ask the name of the variable in a let us call net income and I got this stock diagram.

If you do not click it inside and if you click it somewhere outside, when the cloud will appear on both ends like this rate is click it here and click it here and so call it then I get cloud on both sides. So, sometimes it happens this and suppose it goes very here and click it this is

connected; but sometimes it may not connect and this is going to delete this way yeah all these.

So, these are delete data and I want one variable, that was the interest rate then move our size with (Refer Time: 06:50) it here. Arrows again same thing I click on inside the variable name and to get a curved arrow. It has a nice feature you click it somewhere in the white area and then you click the next variable name will give you a curved arrow principal, then again white area when I do this I get a nice curved arrows. Will give you last specific exercise for that next week's so, let us observe. Then we give the values for each equations you are click equations here then everything in black means you have not given any equation for that.

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So, let us go to principal, it already shows integration of net income I have already integrating net incomes are nothing else to add there; the initial value we told is 100, the main thing we need to write here is what is the units so, that I can do the units check.

So, units here is lets define it has rupees rs so that is a unit there is only thing added here and added initial value is 100, then click ok. Is became white it means some equation is put where equation is right or wrong it will not tell there is something written there as a part of the equation.

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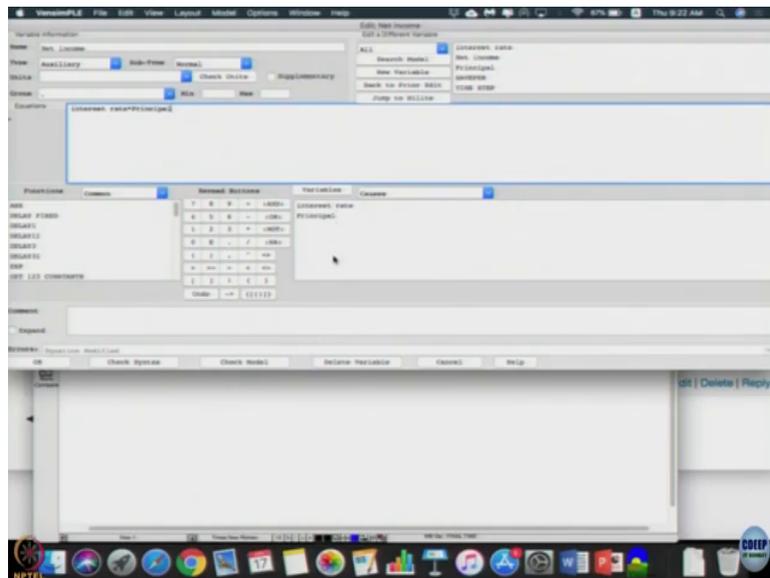


And let us go to interest rate; interest rate is a constant values or let us just put it as a constant 1.5 and units is 1 by here time unit is here; the fraction thing is just 1 over here. And I got a net income and in an equations I have to multiply interest rate into principal.

So, on the big box here you see all the variables which is flowing into the this variable which is connected to this variable. So, you need to form in this case interest rate and principal both the values are coming to the net income. So, I need to form in equation considering both suppose I skip 1.
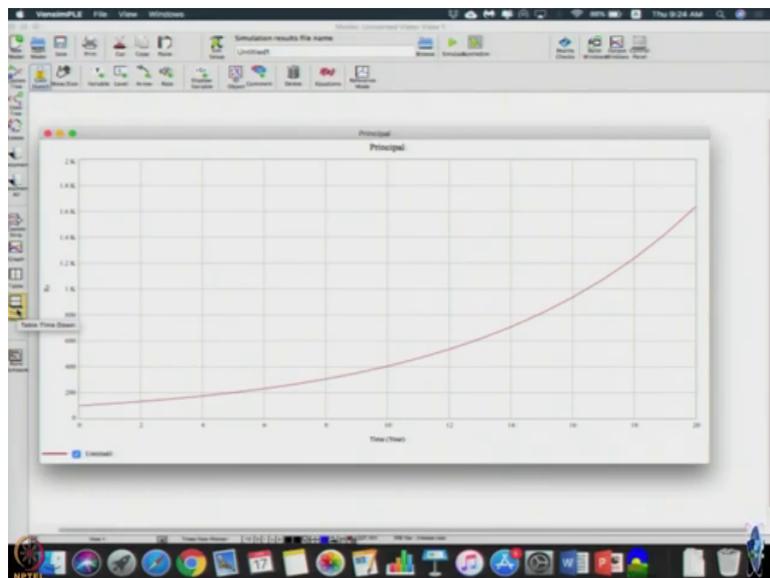
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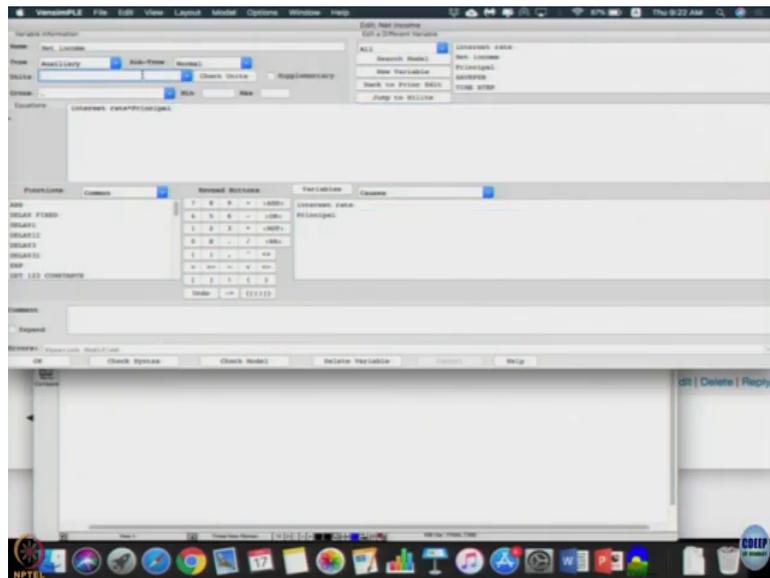


I just put interest rate it will say following input is not used but was expected. Because then you know we have a causal link then you can again go back and then multiply it and add it. And units of this will be rupees per year ok.

So, that is it then if you go to model say units check ok. So, I will just save it all units are ok, good then we go to model check model; model is ok, as it will show there is a type mismatch units mismatch. Or some variable is connected you forgot the equation or some variable is defined but it is not connected to anything else whatever errors it will just show so, but once

we do that we just click this simulate button ok. I just simulated it its simulation is done it does not take. So, long to simulate then we are going to simulate it again or at the data set.
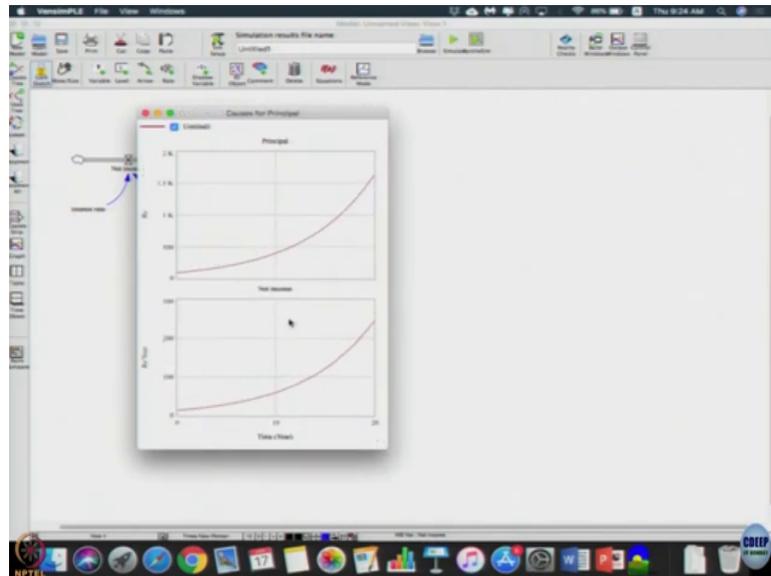
So, in principal now I want to see what is happening, I just clicked it then it becomes what are you select it will be black right because this is I want I click this graphs and I see the graphs ok.

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System nothing as I resized it automatically, rescales it for you or some legends come,

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See I want to see the underlying values when I click this one then I can exactly see the values or it is being computed right. So, I can look at other graph also net income and this one interesting thing suppose I click this one.

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And I click causes strip it shows how that variable changes along with all the variables which are acting as input to this stock is only affected by the flow. So, by one flow in this case, so that stock and how that corresponding flow is happening. So, it sometimes it is useful to see all these things together so that we can compare.

And we can create much more complicated graphs, where even if it is not connected you can select them visualize it. We will learn some of those features later for a modeling per say that is it its not too difficult people can do it. Difficult is finding the equations but drawing it per say its as simple as why you cannot.