Introduction to System Dynamics Modeling
Prof. Jayendran Venkateswaran
Department of Industrial Engineering and Operations Research
Indian Institute of Technology, Bombay

Dynamic of Simple Structures: S - Shaped Growth
Lecture – 10.3
Dynamic of Simple Structures S-Shaped Growth-Customisation in Vensim

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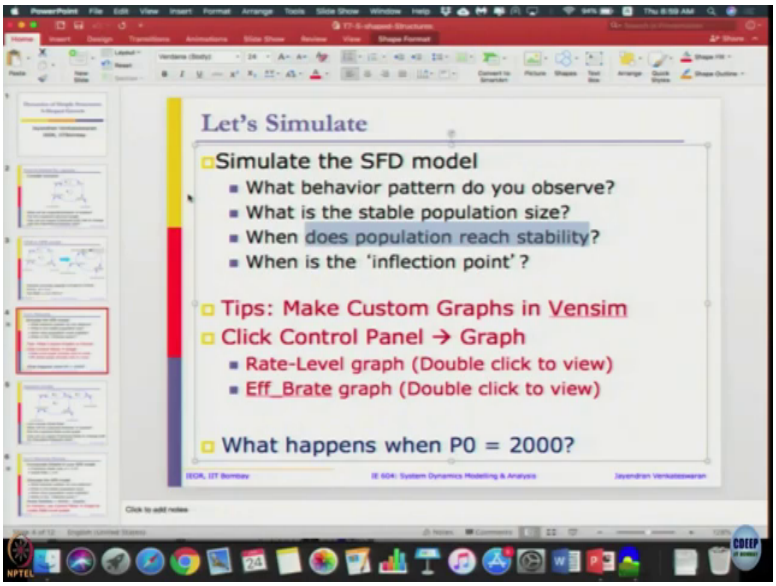

There is a way to make the custom graphs in Vensim. Remember, we draw three graphs in our on the paper. Overtime graph is by default Vensim gives it to us so, no problem. But, then the next two graphs was a rate-level graph and then effective rebirth rate over p by c ratio graph. So, we want to visualize that, so to do that we can create custom graphs in Vensim. I have already created two custom graphs for you.

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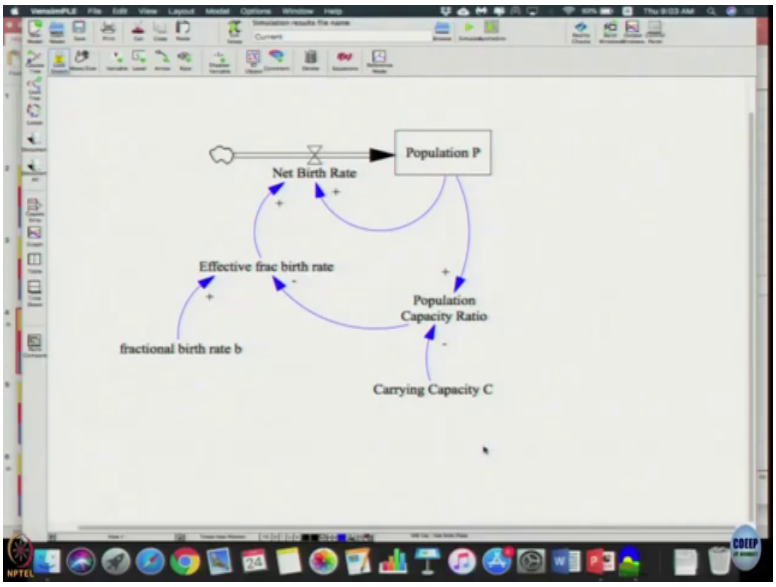

So, to see that on the right top there will be something called is Control Panel in the menu bar. You just observe it is for may it is right here wherever I am moving the mouse you can see it there will be a Control Panel.

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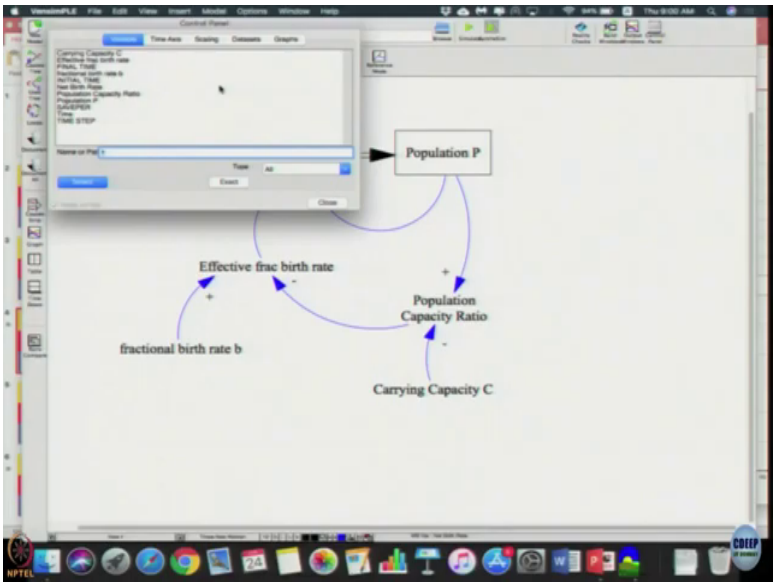

You click that and you will get a control panel with various things.

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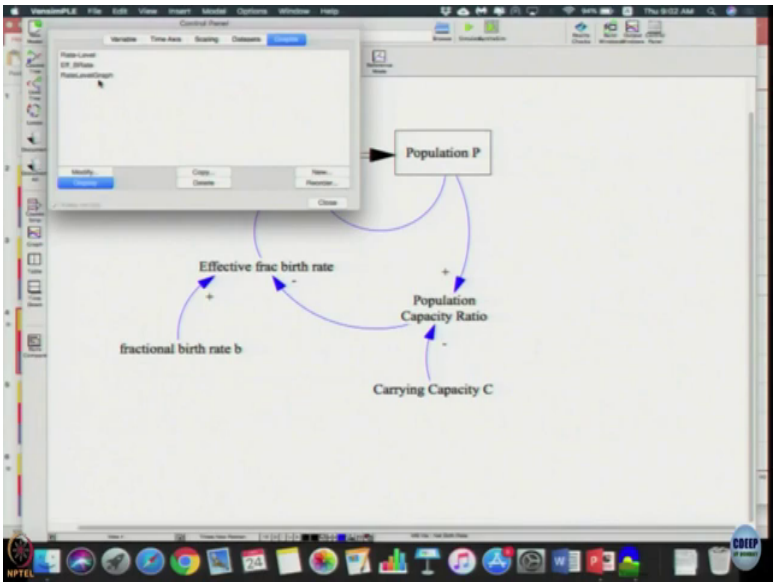

On that you click Graphs and then there is a Rate-Level written there. So, just double click it.

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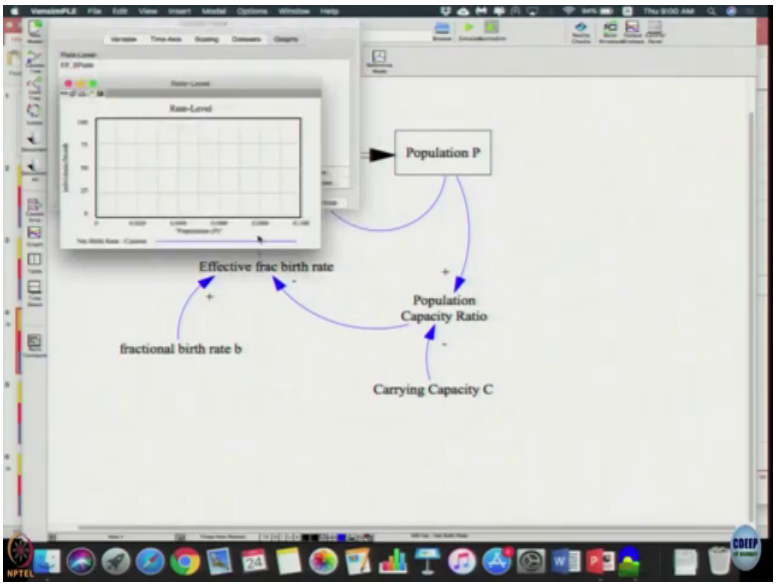

(Refer Time: 01:20) ok. I will use the opportunity create one.

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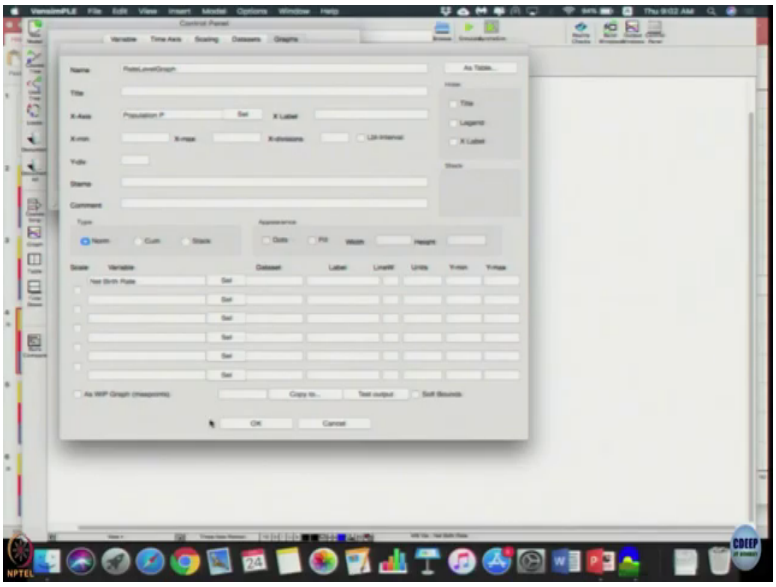

So, once you come to the Graph click New. Name on you get x-axis we want the level. So, I am skipping all the thing I have just went to the Graphs, click New and for the Name let us call it Rate Level Graph. Let us type it as Rate Level Graph in the name.

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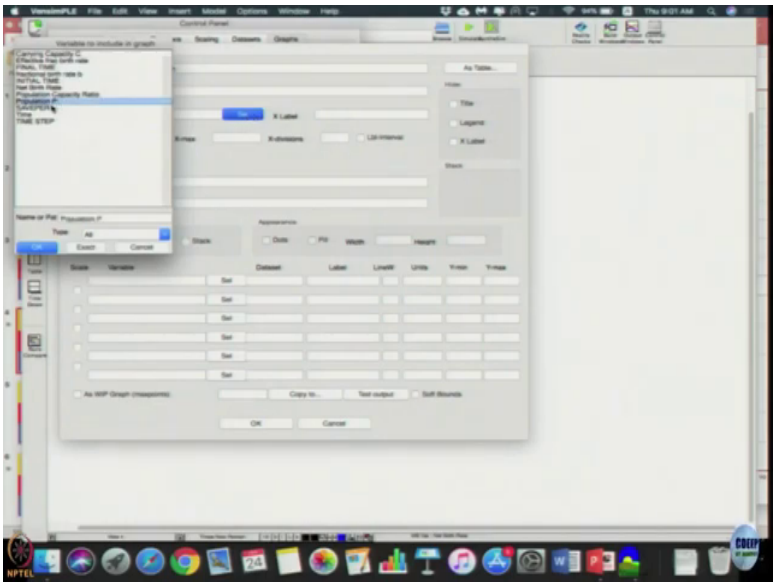

In x-axis let us select click Sel – S e l and select Population P that is the x axis we want we want to make the rate level graph, click Ok. So, you should get at this. Leave everything else just default then come here.

So, this area allows you to select multiple values. So, that we can plot multiple graphs over it, but we want only one. So, in the first row click Sel and click that Net Birth Rate, click Ok. So, only three things are entered – Rate Level Graph as a name; X-Axis Population P and here it says Net Birth Rate that is it. Once you do that you just click Ok and you should have an entry called as Rate Level Graph.

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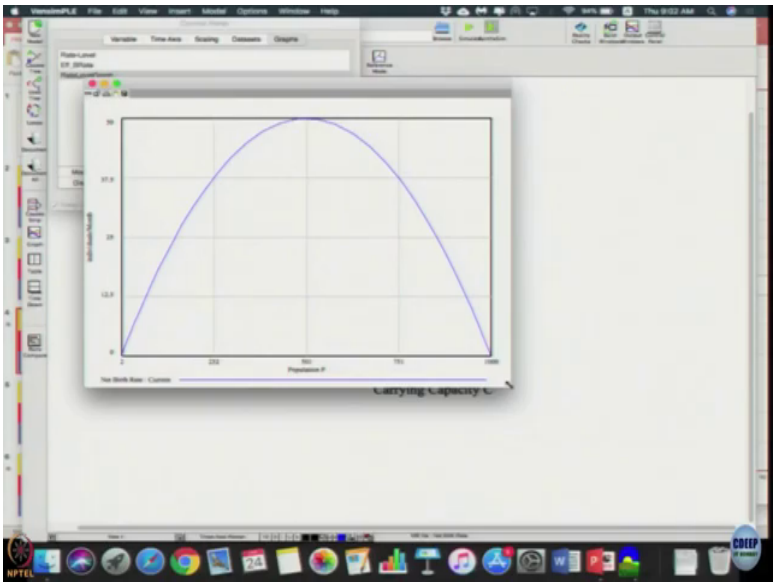

So, you double click it you will see this graph. The same hump shaped graph we saw few minutes ago that we drew is exact same graph that you can get here right. Then selection point is at the population region of 500 which is very apparent here as you can see it from this graph, instead of checking it over time this makes it easier. So, all the graphs that we are trying to do there we can actually simulate and see whether you are getting the exact same values and we can check our intuition and actually develop our intuition better.

So, let us then close this panel come back to this with pair very simple let us say growth is a non-linear system. What happens when P naught is equal to 2000 that is the question what happens when P naught is equal to 2000 whereas, your initial value is much higher than your carrying capacity, then what is this behavior we can expect? It will be purely negative

feedback system growth has to there would not be any growth population has to continue to decline until it reaches the carrying capacity. So, it will be a goal seeking behavior.

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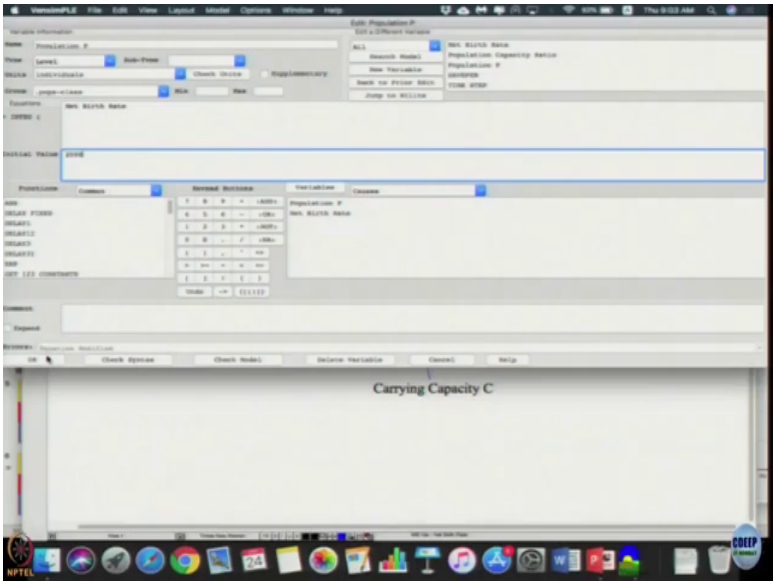

So, let us click f of x, click Population P, change Initial Value to 2000, click Ok run the model again, Yes.

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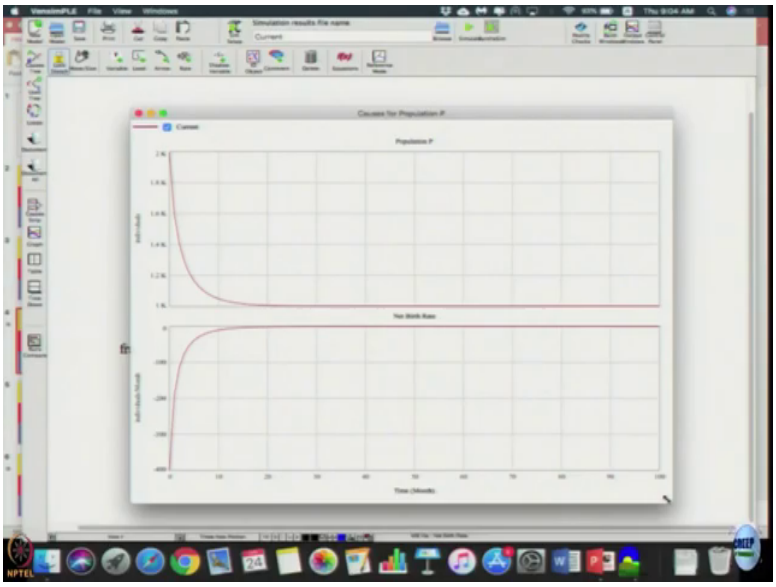

Then click Population, click Process Graph and you can see the same goal seeking behavior that has occur. Any questions on this? Why it occurred the answer is here.

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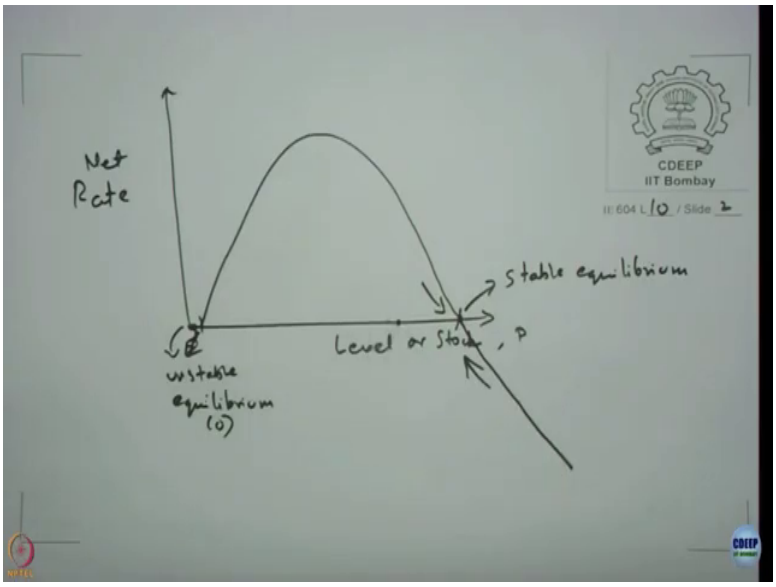

As the net rate is positive or rather as the stock increases up to the value when P by c up to the carrying capacity we can you get a value in all positive direction. So, we expected a growth whether is a asymptotic growth or is exponential growth the expected growth.

But, as the value goes higher so, we are doing 1 minus P by c right ah. So, this becomes negative. So, because of this line so, this becomes your stable equilibrium and this point here is your unstable equilibrium rather at this point 0 it is unstable equilibrium, population is 0 it is there as long as population becomes 1 it becomes it is has to change. So, unstable behavior is at point 0. So, here is 0. This is stable equilibrium.

So, goal will be approached in this direction or in this direction. So, in this direction you get a goal seeking 0 behavior only, but is there it is the starting point is anywhere here you are going to get a exponential growth. If starting point is anywhere here suppose the initial value

of stock was 9000 900, carrying capacity is 1000, initial value is 900 then also you will get a goal seeking behavior only. You will not observe a exponential growth within this system. You can try it.

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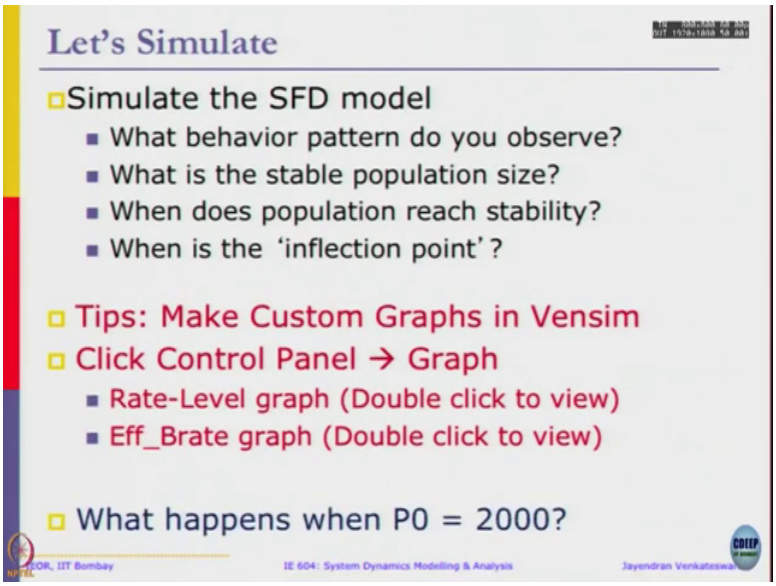

We have done this as well as tried the custom graphs. What happens when P naught is 2000 we have checked it. Is anywhere close to that stable equilibrium point it is going only to exhibit a goal seeking behavior.