Differential equations in Matlab/Simulink

I) Solve the following: $dz(t)/dt=t*e^{-z}$, $z(0)=-2$
Note that t is a linearly increasing signal with slope 1.
I have written the exponential function in the block **Matlab function**.
The initial condition is written in the block **Integrator**.
In Figur Ib you can see the solution !

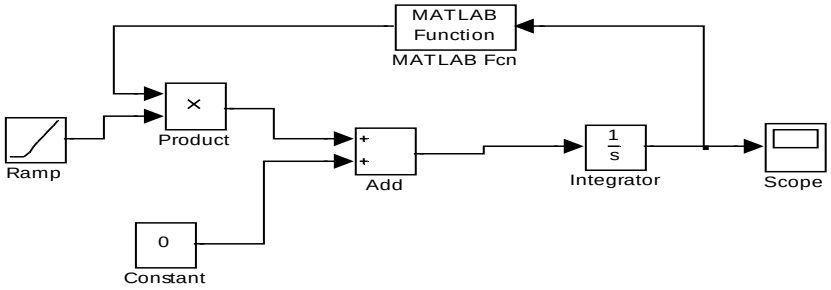

Figure Ia

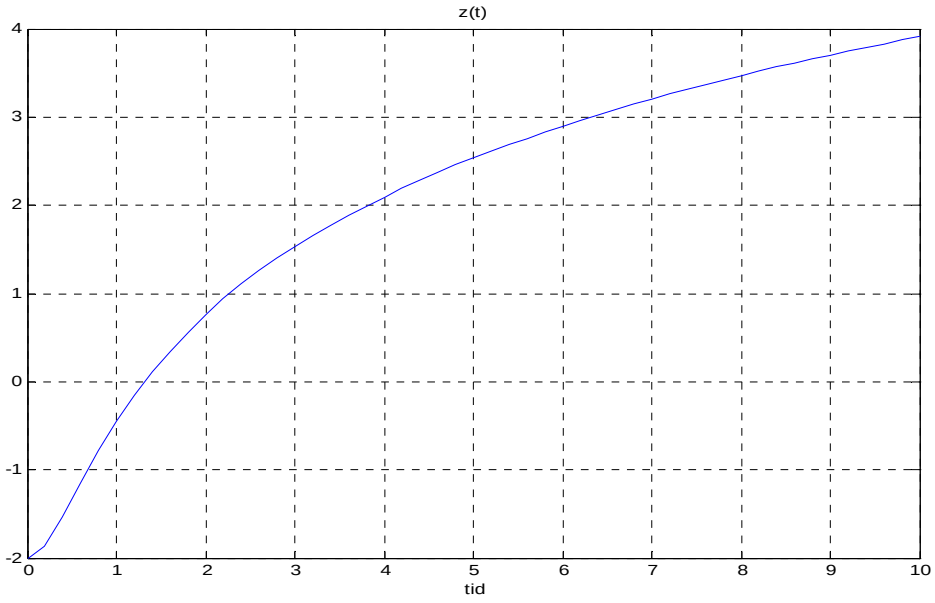

Figure Ib

II) Solve $dz/dt=z^2-z^3+\sin(t)$, $z(0)=0.5$

The differential equation in Simulink is implemented like Figure IIa.
The solution is shown in Figure IIb.

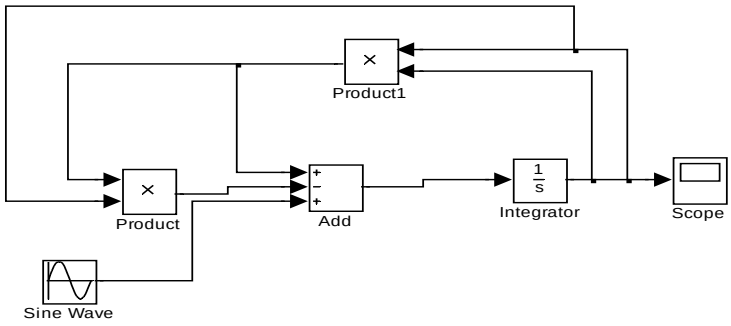

Figure IIa

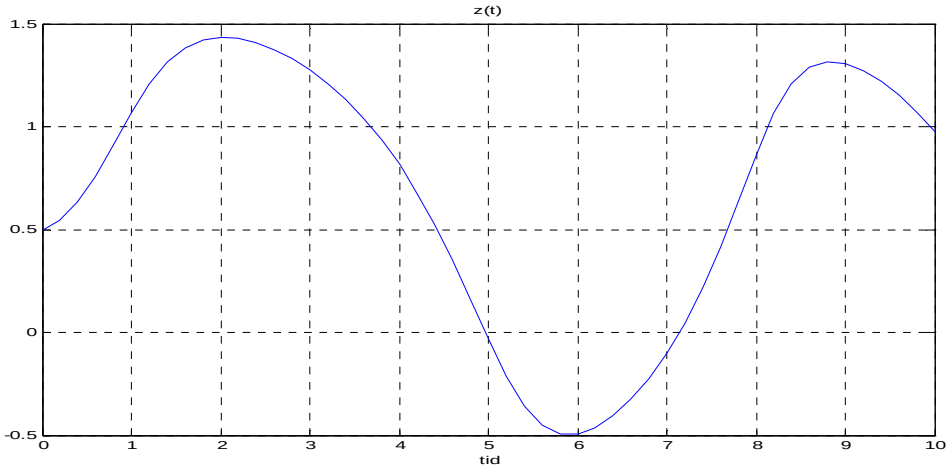

Figure IIb

III) Solve $d^2z(t)/dt^2 - dz(t)/dt + 4z(t) = t*\sin(t)$, $z(0)=1$, $dz(0)/dt=-3$

What kind of strategy to use ? I suggest that you eliminate everything on one side of the equality sign except for the time differentiation of the highest order.
Then formulate the whole differential equation around the **Add** block.
The initial condition dz(0)/dt is inserted into the left integrator and
z(0) in the right. See the solution in Figure IIIb.

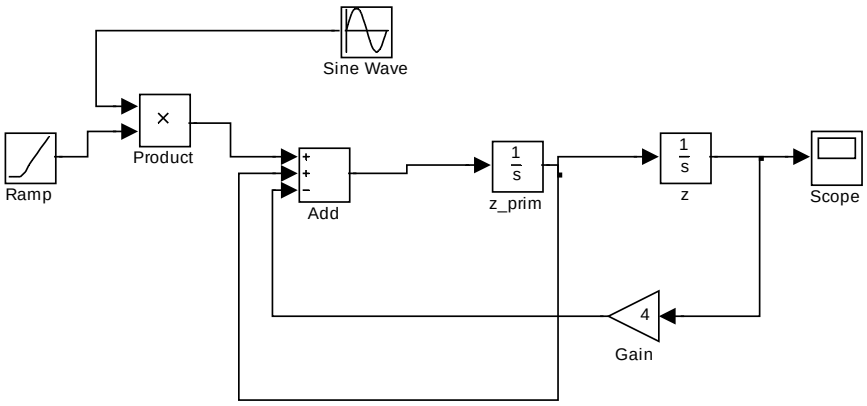

Figure IIIa

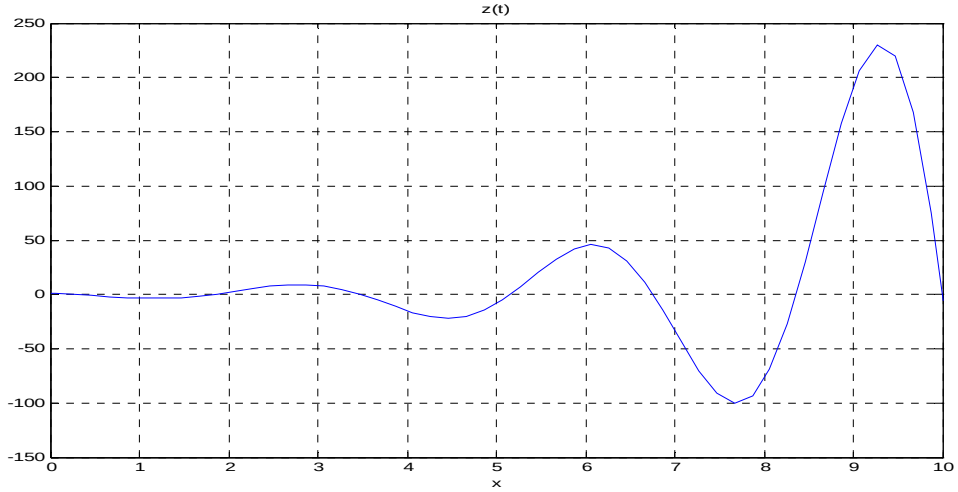

Figure IIIb

IV) Solve: $d^2z(t)/dt^2 - 2dz(t)/dt + 10z(t) * dz(t)/dt = 10*e^{-0.1*\cos(2t)}$
With initial conditions: z(0)=-1 , dz(0)/dt=1
Sine Wave can be changed to a cosine wave by a phase shift of 90^o .
In the Matlab function we have written the following: $10*e^{-0.1t}$.
The initial conditions are inserted into the integrators.
The condition dz(0)/dt is in the left integrator and z(0) in the right.
See the solution in Figure IVb !

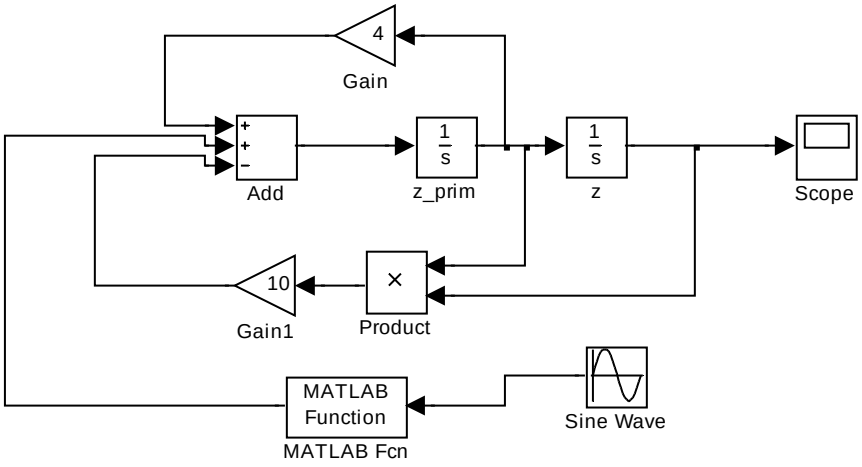

Figure IVa

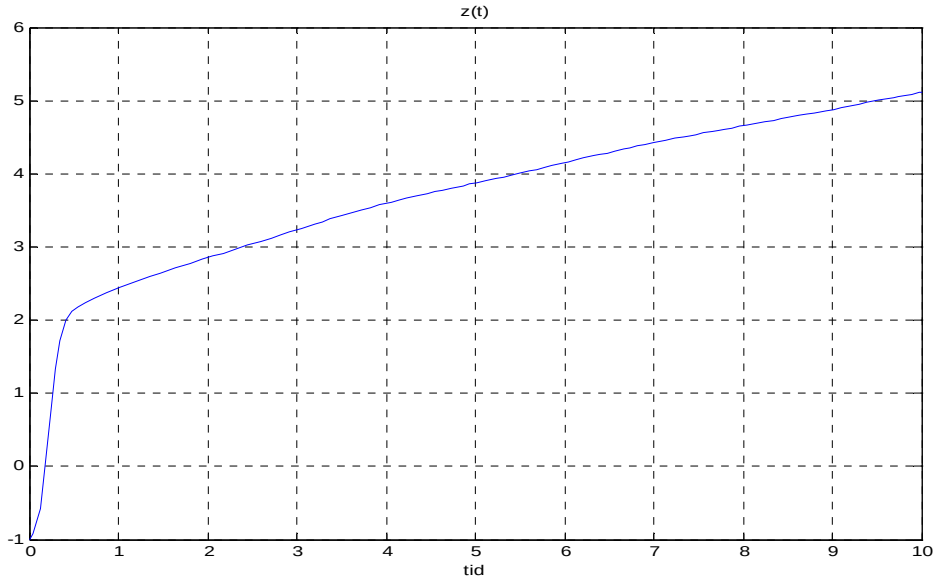

Figure IVb