

CSMP III – statements

Printing

PRINT X, Y

Print-plotted

PRTPLT X

Heading of the printed output

TITLE MySimulation System

Heading of the print-plotted output

LABEL Plot Output of MySimulation System

Closing all of the job

ENDJOB

CSMP III – Example

Example for automobile suspension system

TITLE AUTOMOBILE SUSPENSION SYSTEM

PARAM D = (5.656, 16.968, 39.592, 56.56, 113.12)

X2DOT = (1.0/M) * (K*F – K*X – D*XDOT)

XDOT = INTGRL(0.0, X2DOT)

X = INTGRL(0.0, XDOT)

CONST M = 2.0, F = 1.0, K = 400.0

TIMER DELT=0.005, FINTIM=1.5, PRDEL=0.05, OUTDEL=0.05

PRINT X, XDOT, X2DOT

PRTPLT X

LABEL DISPLACEMENT VERSUS TIME

END

STOP

Combined / hybrid simulation

Three fundamental types of interactions that can occur between discretely changing and continuously changing state variables;

1. A discrete event may cause a discrete change in the value of a continuous state variable
2. A discrete event may cause the relationship governing a continuous state variable to change at a particular time
3. A continuous state variable achieving a threshold value may cause a discrete event to occur or to be scheduled

Feedback Systems

- The system takes feedback from the output i.e. input is ***coupled*** with output
- Example can be; heat monitoring and control system
- Issues – amplification and correction of feedback
- ***Negative feedback*** – control variable is proportional with output
- ***Positive feedback*** – control variable and output are inversely proportional
- Other examples;
 - Aircraft system
 - Error Correction mechanism

Error Correction Mechanism

$Y(t)$ – real output

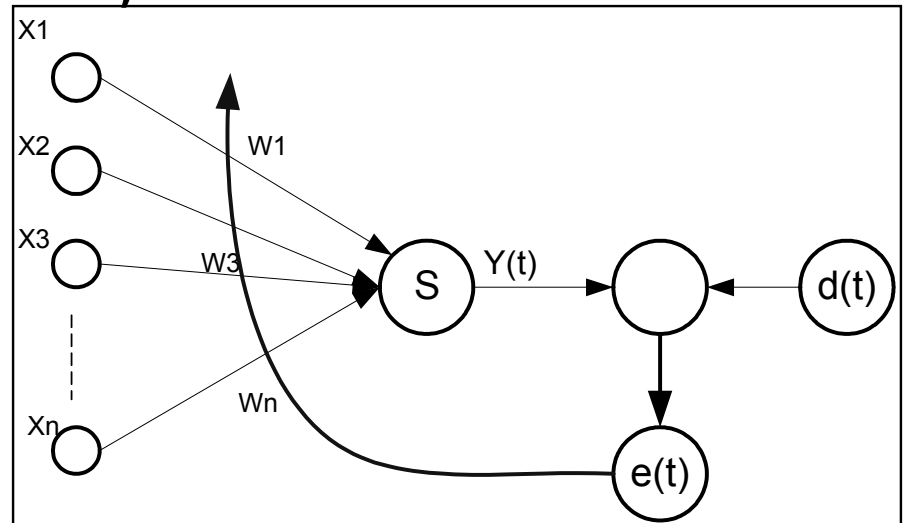
$D(t)$ – desired output

Let error at that instant be;

$$e(t) = D(t) - Y(t)$$

$Y(t)$ is governed as;

$$\sum_{i=0}^n w_i(t) \cdot x_i(t)$$



$e(t)$ is provided as feedback so that it adjusts the values of $w(t)$

The process is stopped if $Y(t) = D(t)$

Interactive Systems

- Systems that support input and output events even the simulation is going on
- Most of the continuous simulation packages provide feature to display output on the screen in the form of text and plots
- Some simulation packages provide facility to change the input parameters as well

Real-time Simulation

- Some devices and their functions are so critical that any model of such devices/sub-systems could not achieve desirable output
- For such systems, the real devices are used
- The real devices are used to provide input/feedback to the simulation programs. The output is also deployed on the real devices
- Such kind of simulation is known as ***real-time*** simulation
- The main reason behind real-time simulation is to simulate the real world events on the real time i.e. the job must be done within predefined time

Homework - 4

Solve problems

4-2, and 4-5

from Chapter – 4 of 'System Simulation' by
Gordon