```
// T18simState.sce
// SIMULATION WITH REg.MOD. IN A STATE-SPACE FORM
// Experiments
// - extend to the 3-rd order model
//   y(t)=b0.u(t)+a1.y(t-1)+b1.u(t-1)+a2.y(t-2)+b2.u(t-2)+
//        +a3.y(t-3)+b3.u(t-3)+k+e(t)
// -------------------------------------------------------------------
exec("ScIntro.sce",-1)
rand('seed',0), mode(0)

// PARAMETERS OF THE SIMULATION                                         // 1
nd=100;                                           // number of data     // 2
                                                                        // 3
e=rand(1,nd,'n');                                 // regression noise   // 4
u=rand(1,nd,'n');                                 // input              // 5
aS=[.6 .1]; b0S=.8; bS=[.3 .2]; kS=2; cvS=.1;     // model parameterers // 6
                                                                        // 7
// REGRESSION REALIZATION                                               // 8
yr(1)=0; yr(2)=1;                                 // initial conditions // 9
// time loop for simulation using regression model                      // 10
for t=3:nd                                                              // 11
  er=sqrt(cvS)*e(t);                              // regression noise   // 12
  yr(t)=aS*[yr(t-1) yr(t-2)]'+b0S*u(t)+bS*[u(t-1) u(t-2)]'+kS+er;       // 13
```

```
                                                  // output
end

// STATE-SPACE REALIZATION
M=[aS(1) bS(1) aS(2) bS(2) kS                     // state parameters
   0     0     0     0     0
   1     0     0     0     0
   0     1     0     0     0
   0     0     0     0     1];
N=[b0S 1 zeros(1,3)]'
A=[1 zeros(1,4)];
B=0;

y(1)=0; y(2)=1;                                  // initial conditions
xt(:,2)=[y(2) u(2) y(1) u(1) 1]';

// time loop of simulation using state-space model
for t=3:nd
  es=[sqrt(cvS)*e(t) zeros(1,4)]';                // state noise
  xt(:,t)=M*xt(:,t-1)+N*u(t)+es;                  // state update
  y(t)=A*xt(:,t);                                 // output
end

```

```
// RESULTS                                                              // 37
scf(1); plot(1:nd,y,1:nd,yr,'.','markersize',4)                         // 38
legend('state model','regression model');                               // 39
```

Description of the program

The program performs simulation of a regression model in two ways: as the plain regression model and in the form of a regression model - the results should be (and are) the same.

- Rows 4–6 prepare parameters of the regression model and input variable.
- Rows 11–14 do regression simulation
- Rows 17–35 perform the state-space simulation
  - 18–25: is construction of the equivalent state-space model
  - 28: initial conditions equivalent to those in row 6
  - 32–35: is the time loop for simulation