```
// T11simReg1.sce
// SECOND ORDER REGRESSION MODEL
// Experiments
// - change parameters of the model
// - change the input signal
// - try to increase the model order to 3
// ---------------------------------------------------------------------
exec("ScIntro.sce",-1), mode(0)

// PARAMETERS OF THE SIMULATION                                        // 1
nd=100;                       // length of data                       // 2
aS=[.4 .2];                   // parameters at y                      // 3
bS=[1 .2 -.5];                // parameters at u                      // 4
kS=5;                         // constant (model absolute term)       // 5
sS=.1;                        // noise std                            // 6
                                                                      // 7
y(1)=1; y(2)=3;               // initial conditions for output        // 8
u=signal(nd,1,.1);            // input                                // 9
thS=[aS bS kS]';              // vector of parameters                 // 10
V=zeros(7,7);                                                        // 11
ka=0;                                                                // 12
                                                                     // 13
// TIME LOOP                                                         // 14
```

```
for t=3:nd                                                          // 15
  ps=[y(t-1) y(t-2) u(t) u(t-1) u(t-2) 1]';  // regression vector    // 16
  y(t)=thS'*ps+sS*rand(1,1,'n');             // simulation           // 17
  Ps=[y(t) ps']';                                                   // 18
  V=V+Ps*Ps';                 // update of statistics              // 19
  ka=ka+1;                                                          // 20
end                                                                 // 21
Vy=V(1,1); Vyp=V(2:$,1); Vp=V(2:$,2:$);                             // 22
thE=inv(Vp)*Vyp;              // parameter estimate                 // 23
                                                                    // 24
// RESULTS OF THE SIMULATION                                        // 25
set(gcf(),"position",[700 100 600 500])                             // 26
subplot(211),plot(1:nd,u),title('Input')                            // 27
subplot(212),plot(1:nd,y),title('Output')                           // 28
disp('The simulated and estimated parameters are',[thS,thE])        // 29
```

Description of the program

- Rows 3–6 define parameters of th model

$$y_t = aS(1)y_{t-1} + aS(2)y_{t-2} + bS(1)u_t + bS(2)u_{t-1} + bS(3)u_{t-2} + kS + e_t,$$

  sS is standard deviation of the noise e_t

- Row 8 defines initial values of y
- Row 9 generates input signal (see function `signal()`)
- Rows 11–12 set initial statistics V and κ (zero prior information)
- Rows 15–21 perform the time loop
  - 16: construction of regression vector
  - 17: simulation
  - 18: extended regression vector
  - 19–20: update of statistics
- Row 22 performs division of information matrix
- Row 23 computes point estimates of the parameters