```
// T23preReg1.sce
// NP-STEP POINT PREDICTION WITH REGRESSION MODEL (KNOWN PARAMETERS)
// Experiments
// Change: - np = number of steps of prediction
//         - r  = noise variance
//         - th = model parametrs
//         - u  = input signal
// Shift of reression vector
// ps(t)=  [u(t) y(t-1) u(t-1) y(t-2) u(t-2) 1]     at time t
//              |----------------|
// ps(t+1)=[u(t+1) y(t) u(t) y(t-1) u(t-1) 1]       at time t+1
//                       |----------------|
// ----------------------------------------------------------------------
exec("ScIntro.sce",-1), mode(0)

// PARAMETERS                                                     // 1
nd=100;                         // number of data                // 2
np=5;                           // length of prediction (np>=1)   // 3
//   b0 a1 b1 a2  b2 k                                           // 4
thS=[1 .4 -.3 -.5 .1 1]';       // regression coefficients        // 5
rS=.02;                         // noise variance                // 6
u=signal(nd,1);                 // input                         // 7
y(1)=1; y(2)=-1;                // prior data                    // 8
```

```
                                                                    // 9
// TIME LOOP                                                        // 10
for t=3:(nd-np)                        // time loop (on-line tasks)  // 11
  // prediction                                                     // 12
  ps=[u(t) y(t-1) u(t-1) y(t-2) u(t-2) 1]'; // first reg. vec       // 13
  yy=ps'*thS;                          // zero prediction for time = t // 14
  for j=1:np                           // predictions for t+1,...,t+np // 15
    ps=[u(t+j); yy; ps(1:$-3); 1]; // reg.vecs with predicted outputs // 16
    yy=ps'*thS;                        // new prediction (partial)   // 17
  end                                                               // 18
  yp(t+np)=yy;                         // final prediction for time t+np // 19
                                                                    // 20
  // simulation                                                     // 21
  ps=[u(t) y(t-1) u(t-1) y(t-2) u(t-2) 1]'; // reg. vector for sim.  // 22
  y(t)=ps'*thS+sqrt(rS)*rand(1,1,'n');      // output generation     // 23
end                                                                 // 24
                                                                    // 25
// RESULTS                                                          // 26
s=(np+3):(nd-np);                                                   // 27
scf(1);                                                             // 28
plot(s,y(s),'.:',s,yp(s),'rx')                                      // 29
set(gca(),"data_bounds",[1 nd -3 5])                                // 30
legend('output','prediction');                                     // 31
```

```
title(string(np)+'-steps ahead prediction')                          // 32
                                                                      // 33
RPE=variance(y(s)-yp(s))/variance(y)     // relative prediction error  // 34
```

Description of the program

Row 3 defines number of steps of the prediction

Rows 5–6 prepare values of parameters

Row 7 defines the input variable

Row 8 sets initial values of y

Rows 11–24 perform the time loop (as we predict when y is not measured, yet, the sequence of the tasks is: prediction (estimate of y(t)), simulation (measuring of y(t))

 13: construction of regression vector

 14: first step of prediction (based on measured data)

 15–18: loop for internal predictions (all unknown values of y are substituted by heir estimates from the previous steps)

  16: construction of regression vector (predictions of y from previous steps are included).

  Note: For the shift of the regression vector see the head of the program.

  17: generation of the new prediction

 19: the final prediction at the time t+np

 22: regression vector fo simulation

 23: simulation of new y(t)