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// T21preReg.sce
// ZERO-STEP PREDICTION WITH REGRESSION MODEL
// - unknown parameters
// Experiments
// - change parameters of the model
// - change the input signal
// - change initial statistics
// - try to increase the model order to 3
// - show evolution of the parameters estimates
// -----
exec("ScIntro.sce",-1), mode(0)

// PARAMETERS AND INITIAL STATISTICS // 1
nd=1000; // length of data // 2
b0S=1; a1S=.4; b1S=.2; kS=-1; rS=.1; // model parameter // 3
thS=[b0S a1S b1S kS]'; // 4
u=signal(nd); // definition of input // 5
V=1e-5*eye(5,5); // initial statistics // 6
ka=0; y=0; // initial ka and y // 7
b0E=0; a1E=0; b1E=0; kE=0; // initial parameters // 8
// 9
// TIME LOOP // 10
for t=2:nd // 11

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// prediction // 12
yp(t)=b0E*u(t)+a1E*y(t-1)+b1E*u(t-1)+kE; // 13
// 14

// simulation // 15
y(t)=b0S*u(t)+a1S*y(t-1)+b1S*u(t-1)+kS+sqrt(rS)*rand(1,1,'n'); // 16
// simulation // 17
// 18

// estimation // 19
Ps=[y(t) u(t) y(t-1) u(t-1) 1]'; // ext. regression vector // 20
V=V+Ps*Ps'; // update of statistics // 21
ka=ka+1; // update of statistics // 22
Vy=V(1,1); Vyp=V(2:$,1); Vp=V(2:$,2:$); // division of inf.matrix // 23
thE=inv(Vp)*Vyp; // point regr.coefficients // 24
rE=(Vy-Vyp'*thE)/ka; // point mosel variance // 25
b0E=thE(1); a1E=thE(2); b1E=thE(3); kE=thE(4); // 26
end // 27
// 28

// RESULTS // 29
disp('Simulated thS',thS) // 30
disp('Estimate thE',thE) // 31
// 32

set(scf(),'position',[600 100 600 400]); // 33
plot(1:nd,y,1:nd,yp); // 34

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title 'Output and its prediction' // 35
// 36
RPE=rpe(y,yp); // 37
disp('Relative prediction error',RPE) // 38
```

### **Description of the program**

- Rows 3–4 prepare parameters of the model
- Row 5 defines input signal
- Rows 6–8 set initial statistics and parameter estimates
- Rows 11-26 perform the time loop
  - 13: prediction
  - 16: simulation (data measurement)
  - 20–26: estimation (with newly measured y)
    - \* 20: extended regression vector
    - \* 21–22: update of statistics
    - \* 24–25: point estimates of parameters