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// T11simReg3.sce
// ECOND ORDER REGRESSION MODEL AND LS ESTIMATION
// 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 // 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
// 10
// TIME LOOP // 11
thS=[aS bS kS]'; // vector of parameters // 12
for t=3:nd // 13
    ps=[y(t-1) y(t-2) u(t) u(t-1) u(t-2) 1]'; // regression vector // 14

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    y(t)=thS'*ps+sS*rand(1,1,'n');           // simulation           // 15
    Y(t)=y(t);                                // 16
    X(t,:)=ps';                                // 17
end                                             // 18
thE=inv(X'*X)*X'*Y;                           // 19
                                              // 20
// RESULTS OF THE SIMULATION                  // 21
set(gcf(),"position",[700 100 600 500])       // 22
subplot(211),plot(1:nd,u),title('Input')      // 23
subplot(212),plot(1:nd,y),title('Output')     // 24
disp('The simulated and estimated parameters are',[thS,thE]) // 25

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Description of the program

- Rows 2–6 set parameters of the model
- Row 8 sets the initial conditions
- Row 9 generates input signal
- Row 6 are initial statistics (no prior information)
- Rows 13–18 perform the time loop
 - 14: construction of regression vector
 - 15: simulation

- 16–17: construction of X and Y for least squares
- Row 19 performs point estimates of parameters