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1 % A simple simulation using AR(1)
2 % Ensemble versus realization
3
4 % First set of realization for AR(1) with alpha=0.4 and sigma=0.2
5 %  $X(t+1) = \alpha * X(t) + \text{Error}$ ; Error ~ Normal (0,Variance)
6 num_realize=4;
7 num_values=100;
8
9 ar1param=0.4;
10 errsigma=0.5;
11 errmean=0;
12
13 for k=1:num_realize % Loop for multiple realizations of AR(1) model with
    identical parameters
14     x(1)=normrnd(errmean,errsigma); % Initialize first value of series
15     for i=1:(num_values-1) % Loop to calculate time series values using the given
        model
16         x(i+1)=ar1param*x(i)+normrnd(errmean,errsigma);
17     end
18     for i=1:num_values % Loop to store time series values in each realization
19         y(k,i)=x(i);
20     end
21 end
22
23 figure
24 for i=1:4
25     subplot(2,2,i)
26     plot(y(i,:))
27 end
28
29
30 % Second set of realization for AR(1) with alpha=-0.3 and sigma=0.5
31 %  $X(t+1) = \alpha * X(t) + \text{Error}$ ; Error ~ Normal (0,Variance)
32 num_realize=4;
33 num_values=100;
34
35 ar1param=-0.3;
36 errsigma=0.2;
37 errmean=0;
38
39 for k=1:num_realize % Loop for multiple realizations of AR(1) model with
    identical parameters
40     x(1)=normrnd(errmean,errsigma); % Initialize first value of series
41     for i=1:(num_values-1) % Loop to calculate time series values using the given
        model
42         x(i+1)=ar1param*x(i)+normrnd(errmean,errsigma);
43     end
44     for i=1:num_values % Loop to store time series values in each realization
45         y(k,i)=x(i);
46     end
47 end
48

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49 figure
50 for i=1:4
51     subplot(2,2,i)
52     plot(y(i,:))
53 end
54
55
56 % Deterministic models
57
58 for i=1:num_values % Simulate purely deterministic time series
59     det1(i)=20; % Constant Mean
60     det2(i)=0.02*i; % Linear
61     det3(i)=cos(i*2*3.1412/20); % Seasonal (Cosine)
62     det4(i)=0.1*exp((i-15)/25); % Exponential
63 end
64
65 for i=1:num_values % Simulate time series with deterministic and AR(1) stochastic
    components
66     ser1(i) = y(1,i) + det1(i); % Constant Mean + Random
67     ser2(i) = y(1,i) + det2(i); % Linear + Random
68     ser3(i) = y(1,i) + det3(i); % Seasonal (Cosine) + Random
69     ser4(i) = y(1,i) + det4(i); % Exponential + Random
70 end
71
72 figure
73 subplot(221)
74 plot(ser1)
75 subplot(222)
76 plot(ser2)
77 subplot(223)
78 plot(ser3)
79 subplot(224)
80 plot(ser4)

```