Lista de Exercícios no. 4
Estimação Paramétrica

Considere um sistema dinâmico linear excitado com uma entrada conhecida. As seqüências das entradas e das saídas medidas nos instantes correspondentes estão disponíveis no arquivo `dados.mat` no formato de leitura/gravação padrão do MATLAB. Utilizando comandos do próprio MATLAB faça um procedimento de identificação paramétrica desse sistema. Determine o modelo de menor ordem que represente os dados desse arquivo. Para a determinação da melhor estrutura avalie a correlação do erro previsto e o critério otimizado (somatória do erro quadrático).

Considere os comandos:

```
load
  LOAD FNAME  retrieves the variables from the MAT-file 'fname.mat'.


armax
  ARMAX  Computes the prediction error estimate of an ARMAX model.
  TH = ARMAX(Z,NN) or TH = ARMAX(Z,NN,'trace')

      TH: returned as the estimated parameters of the ARMAX model
      A(q) y(t) = B(q) u(t-nk) + C(q) e(t)
      along with estimated covariances and structure information.

      For the exact format of TH, see also THETA.

      Z : The output-input data Z=[y u], with y and u being column vectors.
      NN=[na nb nc nk], the orders and delay of the above model.


iv4
   IV4 Computes approximately optimal Instrumental Variable estimates for ARX-models.
   TH = IV4(Z,NN)

      TH: returned as the estimate of the ARX model
      A(q) y(t) = B(q) u(t-nk) + v(t)
      along with estimated covariances and structure information.

      For the exact format of TH see also THETA.

      Z : the output-input data Z=[y u], with y and u as column vectors.
      NN= [na nb nc nk], the orders and delay of the above model.


th2tf
    TH2TF Transforms from the THETA-format to transfer functions.
    [NUM,DEN] = TH2TF(TH,IU)
```

```
      TH: The model, defined in the THETA-format (See also THETA).
      IU: The input number (default 1) to be considered. Noise source is counted as input
      number -1.

      NUM: The numerator(s) of the transfer function.
      DEN: The denominator of the transfer function.


pe
    PE  Computes prediction errors.
    E = PE(Z,TH)

      E : The prediction errors
      Z : The output-input data Z= [y u]
      TH: The model. Format as in HELP THETA


covf
    COVF  Computes the covariance function estimate for a data matrix.
    R = COVF(Z,M)

      Z : An  N x nz data matrix, typically Z= [y u]
      M : The maximum delay - 1, for which the covariance function is estimated
      R : The covariance function of Z, returned so that the entry
          R((i+(j-1)*nz,k+1) is the estimate of E Zi(t) * Zj(t+k)
      The size of R is thus nz^2 x M.
```

Ex: Gráfico da Covariância

```
ir=covf(e,lag); ir=ir/ir(1);
t=0:(lag-1); l=ones(lag,1)*1.96/sqrt(length(e)); % Gera o intervalo de confiança
plot(t,ir,t,l,'k:',t,-l,'k:',0,1,'k.',0,-1,'k.')
```