Electrical Engineering Department

EEL774 System Identification & Parameter Estimation

Major Test, Date 3-5-'08

Max. Marks = 40

Answer all questions.

Q.1 Consider a non-linear differential equation of the Vander-pol type

$$\ddot{x} + \alpha(1-x^2)\dot{x} + \beta x = 0$$

Where α and β are unknown parameters to be estimated. Design an experiment to identify α and β using quasilinearization method. 8 Marks

Q.2 Consider a scalar non-linear differential equation model of a System. The record of input and output of the System is given. Use suitable orthogonal polynomial to identify unknown parameters of the System recursively. 8 Marks

Q.3 Derive the method for recursive identification of of impulse response of a LTI System using orthogonal series expansion, or by any other method. Consider that imperfect record of impulse response is available.

Also derive a method for identification of the transfer function $G(s,\tau)$ of the time varying System. — 8 Marks

Q.4 Consider a System described by

$$A^*(z^{-1})y(k) = B^*(z^{-1})U(k) + \mathcal{E}_k$$

Where $A^*(z^{-1})$, $B^*(z^{-1})$, $y(k)$, $U(k)$ and $\mathcal{E}(k)$ have usual meanings.

Q. 5. A System is described by the following partial differential equation

$$a_2 \frac{\partial y(x,t)}{\partial t} + a_1 \frac{\partial y(x,t)}{\partial x} + a_0 y(x,t) = U(x,t)$$

Design an experiment to identify the unknown parameters a_2, a_1, and a_0 of the System from the simultaneous record of input and output. Make use of Laguerre polynomials.

— 8 Marks.