MEIC - 201 Fuzzy Maths and Applications to Controllers

Unit 1

THE MATHEMATICS OF FUZZY CONTROL:

Fuzzy Set vagueness, fuzzy set theory versus probability theory, classical set theory, fuzzy set, properties of fuzzy sets, operations on fuzzy sets, fuzzy relations, operations on fuzzy relations. The Extensions principle, Approximate reasoning, linguistic variable fuzzy propositions, fuzzy. If then statements, inference rules, the compositional rule of inference.

Unit 2

KNOWLEDGE BASE CONTROLLER:

The structure of a F K B C fuzzification module, knowledge base, inference engine, defuzzification module, rule base, choice of variables and content of rules, choice of term set, derivation of rules, date base choice of membership functions, choice of scaling factors. Inference engine, choice of fuzzification procedure choice of defuzzification procedure, center of area gravity, center of , sums, Height, center of largest area, first of maxima middle of maxima.

3.NON LINEAR FUZZY CONTROL:

F K B C as a non linear transfer element F K B C computational structure, the Non linearity of the controller, Rule based representation of conventional T E types of F K B C, P I D like F K B C sliding mode F K B C sugeno F K B C.

4. NEURAL NETWORK:

Basic of Neural Network different of neural architecture, single input neuron, transfer functions multiple input neuron Network architectures, a layer of neurons, multiple layer of neurons.

5. Perceptions linear network, back propagation Radial basis network. Association learning rules, self organizing networks, learning vector quanitization recurrent networks.

BOOKS RECOMEDED :

1. An introduction to fuzzy control "Bruce Graham and Anifal Ollero"
2. Neural Network Tool box "MATLAB' ,

MEIC – 202 Optimal & Adaptive control

Unit 1
Basic mathematical preliminaries-set theory, convexity,

Unit 2
Development of feedback control laws through state space technique modal control, pole placement problem.

Unit 3 OPTIMAL CONTROL
Condition for optimality, variational calculus approach, optimal feedback control of linear deterministic systems, matrix Riccati equation, linear regulator problem, Pontrygin maximum principle, Hamilton-Jacobi Bellman Theory, structure and properties of optimal systems, various types of constraints, singular solution, minimum time and minimum fuel problems, sensitivity of optimal systems, second variations and neighboring extremes, penalty function method.

Unit 4 ADAPTIVE CONTROL
Adaptive control schemes and introduction to adaptive optimal problems, Models reference adaptive control, Design of adaptive system, Learning model approach, input signal adaptive systems adaptive auto-pilot, some practical illustrations.

BOOK RECOMMENDED:
1. A.P. Sage-Optima] System Control, Prentice Hall
2. Athens and Fa]b-Optimal control, Mc Graw Hill
3. D.E. Kirk-Optima] control theory Prentice Hall
4. Polak-Computation methods in optimization, Academic press.

MEIC – 203 State Estimation and system Identification

Unit 1

ESTIMATION: Optimum State estimation in linear stationary systems, Wiener filters, optimal filtering of non stationary continuous systems, Kalman Bucy filters.

Unit 2

Full and reduced order observers, least square curve fitting, state estimation and discrete linear systems, nonlinear estimation.

Unit 3

IDENTIFICATION: Classical and modem techniques of system identification, impulse response identification, correlation techniques, matched filter identification.

Unit 4

Transfer function evaluation, cost function for system identification, gradient technique, stochastic approximation, quasi-linearization, invariant impending.

BOOK RECOMMENDED:

1. Sage-Optimum System control, Prentice Hall
2. Sage ann MeJsa -Sy~t.em Identificatior1, Academic Press New York.
3. Sage and Melsa- Estimation theory with applications to Communication and Control, Mc Graw Hill.

MEIC – 204 Pattern Recognition

Unit 1

MASK MATCHING Optical mask matching, electronic mask matching using analogue grey scale, digital grey scale, score maximization, peephole masks, negative weights.

Unit 2

PREPROCESSING FOR CHARACTER RECOGNITION Conversion from visual detection and
to electrical patterns, binarisation, alignment, smoothing e
thining.

Unit 3

LINEAR TECHNIQUES Recognition class, minimum error baycsian classifier, statistical independence, Gaussian distribution cross correlation with normalized average masks, linear discriminant functions, fixed increment procedure pattern error, Dischotemisation schemes, Karhuncn-Leave expansion.

Unit 4

PIECE WISE TECHNIQUES Piece-wise linear discriminant functions, intuitively determined subclasses, nearest neighbour method, firschein and fischlers method, piecewise linear fixed increment procedure, the method of potentials, stochastic approximation in pattern recognition.

Unit 5

POLYNOMIAL DISCRIMINANTS A N TUPLE MEHODS Least square approximation maximum likelihood n-topple method, Bledsoe and Browning method ,polynomial discriminate functions, Automatic selection means of information criterion, shifted peephole mask systems.

Unit 6

BOOLEAN AND SEQUENTIAL DECISION MAKING Boolean Functions, recognition systems using Boolean functions, incompletely specified Boolean functions implementation of Boolean functions using numerical functions non-numerical sequential recognition, decision making strategies. Introduction to zoned features, graph representation techniques-, sequentially detected features, discussion of features. Crossing counting techniques.

Unit 7

CONTEXTUAL LINGUISTIC AND ARRAY TECHNIQUES Context, scene analysis, picture syntax, analysis by synthesis, iterative array techniques, Higher moments, slit scanning techniques, Fourier Transformation, pattern recognition by Fourier optics, autocorrelation, speech recognition

Unit 8

LEARNING Unsupervised learning, automatic determination of features, transference of learning, associative memory, scientific basis of automatic pattern recognition.

BOOKS RECOMMENDED:

1. H C Andrews, Introduction to Mathematical Techniques in Recognitions Wiley
2. M Nongard, Pattern recognition Spartan Books 1970
3. J R Villrnann , Pattern Recognition Techniques, Butterworths 1973

MEIC – 205 Advanced Controlled System

UNIT – I

through differential equations and

Rewiew of Linear Control System: M

difference equation, state space method of description and its solution, discretization of continuous-time state space model, Laplace and z-domain analyses of control systems, Controllability, operability & Stability, Dode & Nyquist analysis, Root Loci, Effect of load disturbance upon control actions.

UNIT-II

Development of feedback control laws through state space technique modal control, pole placement problem.

UNIT-III

Variable Structure control and its applications. Examples on variable structure control.

UNIT-IV

Control of nonlinear dynamics: Lyapunov based control function, Phase plane technique, Liapunov stability analysis.

UNIT –V

Optimal control: Calculus of variation, Euler-Lagrange equations, Boundary conditions, Transversal condition Bolza problem, Pontyazin's maximum principle.

Books

1. Automatic Control System – B.C. Kuo, Prentice Hall, New York, 1975
2. Modern Control Engineering K. Ogata, Prentice Hall of India Ltd. New Delhi,1992
3. Digital control system B.C. Kuo Oxford Pub.
4. Discrete Time Control Systems – K. Ogata. Prentice Hall of India Ltd. New Delhi.
5. Optimum System Control Andrew P. Sage, Prentice Hall New York, 1970
6. Advanced Control System- B.S.Manake,Khanna Publication