Code No: 07A7EC41 **R07** **Set No. 2**

IV B.Tech I Semester Examinations,November 2010
ADAPTIVE CONTROL SYSTEMS
Instrumentation And Control Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) With a neat block diagram, explain robust high gain control.
   (b) State and explain MIT rule. [8+8]
2. (a) Explain the advantages and disadvantages of gain scheduling.
   (b) Define gain scheduling. Explain its applications. [8+8]
3. (a) Explain the design of minimum variance controller algorithm.
   (b) Explain the basic direct self tuning algorithm. [8+8]
4. (a) Check whether the transfer function G(s) = $\frac{s^2+6s+8}{s^2+4s+8}$ is SPR.
   (b) Explain how SPR for a system can be tested using Kalman-Yakubovich lemma. [8+8]
5. (a) Explain pole placement design procedure for self tuning regulator.
   (b) Discuss the properties of indirect self tuning algorithm with an example.[8+8]
6. (a) Explain the transfer function estimation method.
   (b) Describe recursive maximum likelihood method. [8+8]
7. (a) Consider the transfer function of a plant G(s) = $\frac{1}{s(s+b)}$, where b is an unknown parameter. Determine the MRAC that can give the closed loop system G_m(s) = $\frac{\omega^2}{s^2+2\delta\omega s+\omega^2}$
   (b) With the help of suitable diagram, explain MRACS. [8+8]
8. Consider a process characterized by the transfer function
   G(s)=$\frac{k}{1+sT}e^{-sL}$. Show that the parameters T and L are exactly satisfy the following relations: T+L=$\frac{A_0}{K}$, T =$\frac{eA_1}{k}$ [16]

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Code No: 07A7EC41 **R07** **Set No. 4**

IV B.Tech I Semester Examinations,November 2010
ADAPTIVE CONTROL SYSTEMS
Instrumentation And Control Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) With an example, explain the adjustment of a friction compensator in process control system.
   (b) Explain the procedure to decide the type of the controller to be used in control systems. [8+8]
2. (a) Discuss about frequency domain characterization, of a signal.
   (b) Discuss about matrix inversion lemma to compute transformation matrix 'P'. [8+8]
3. (a) Explain the algorithm for hybrid self tuner.
   (b) Explain about direct self tuning regulators. [8+8]
4. Explain methods for constructing Lyapunov functions for linear systems with an example in each case. [16]
5. Gain scheduling reduces parameter variations. Explain with suitable examples. [16]
6. (a) Explain about a linear system with relay control.
   (b) Discuss about relay oscillations. [8+8]
7. (a) Consider a process given by
   y(t) + ay(t-1) = bu(t-1) +e(t)+ce(t-1)
   where a = -1.8, b = 2, c = -0.5. Discuss the effects of filtering on the system.
   (b) Describe how minimum variance controller can be interpreted as pole placement controller. [8+8]
8. Consider the process
   $G(s) = \frac{1}{s(s+a)}$
   where 'a' is unknown parameter. Determine a controller that can give the closed loop system $G_m(s)= \frac{\omega^2}{s^2+2\delta\omega s+\omega^2}$. Determine MRAS based on stability theory. [16]

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Code No: 07A7EC41 **R07** **Set No. 1**

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ADAPTIVE CONTROL SYSTEMS
Instrumentation And Control Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) Explain asymptotic properties of stochastic STRs.
   (b) Discuss about unification of direct STRs. [8+8]
2. (a) Explain the Ziegler-Nichols closed loop method.
   (b) Discuss about auto tuning of cascaded tanks . [8+8]
3. Explain the following:
   (a) Certainity equivalence principle
   (b) Underlying design problem
   (c) Hyper state. [6+5+5]
4. Explain in detail any two applications of gain scheduling. [16]
5. (a) Explain Lyapunov stability analysis.
   (b) What is Lyapunov function? Explain the methods for constructing Lyapunov functions. [8+8]
6. (a) Explain about stochastic approximation algorithm.
   (b) Define random, periodic, pulse and step signals in stochastic process. [8+8]
7. Consider a position servo described by
   $\frac{dv}{dt}$ = -av + bu ; $\frac{dy}{dt}$ = v
   where parameters a and b are unknown. Assume that the control law
   u = θ_1(u_c-y)- θ_2v is used and that it is desired to control the system in such a way that the transfer function from command signal to process output is given by $G_m(s) = \frac{\omega^2}{s^2+2\delta\omega s+\omega^2}$. Determine an adaptive control law that adjusts parameters θ_1 and θ_2 so that the desired objective is obtained. [16]
8. A process has the transfer function $G(s) = \frac{b}{s(s+1)}$ where b is a time varying parameter. The system is controlled by proportional controller u(t) = K(u_c(t) - y(t)). It is desirable to choose the feed back gain so that the closed loop system has the transfer function $G(s) = \frac{4}{s^2+s+16}$. Construct a continuous time indirect self tuning algorithm for the system. [16]

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Code No: 07A7EC41 **R07** **Set No. 3**

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is passivity?
   (b) Describe passive system with an example. [5+11]
2. (a) Explain the Parseval's theorem and discuss its significance.
   (b) Explain the auto regressive model. [8+8]
3. With the help of block diagram, explain self tuning regulator, explain the principle of self tuning regulator. [16]
4. (a) Gain scheduling can be regarded as adaptive controllers Justify.
   (b) Gain scheduling can be used to compensate non-linearities - Discuss. [8+8]
5. (a) Explain the draw backs of adaptive control.
   (b) Write about certainity equivalence principle.
   (c) Write about different steps to construct an adaptive controller. [6+5+5]
6. (a) Consider a process
   $A(q) = q^2 - 1.5q + 0.7$
   $B(q) = q + b_1$
   $C(q) = q^2 - q + 0.2$
   Determine the variance of the closed loop system as a function of b_1 when the moving average control is used. Compare with lowest achievable variance.
   (b) Describe LQG control. [10+6]
7. Explain the following:
   (a) Controller structure
   (b) Parameter adjustment law. [8+8]
8. Consider a process described the transfer function $G(s)=\frac{k}{1+s\tau}\ e^{-sL}$. Obtain the amplitude margin for the system and show that it is identical to the setting obtained by applying Zieler-Nichols rule. [16]

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