CMPSCI 603 MIDTERM EXAM I REVIEW S22

Thursday 3/10 take Home Exam, Open Book/Notes
24 hours, 75+15 (upload) minutes

1. Introduction: Chapter 1
   (a) Knowledge and Representation - explicit, implicit, tacit
   (b) Braitenberg's vehicles, Augmented Finite State Machine (AFSM)
   (c) "cybernetics," closed-loop processes, biological homeostasis (chemical regulators of temperature, blood sugar, blood pressure, etc.)
2. Actuators: Chapter 2
   (a) muscle tissue - actin and myosin, Huxley model
   (b) DC motor - Lorentz force, commutation, cogging, back EMF, motor performance curves, gearboxes
   (c) Hydraulic, pneumatic, shape memory alloys, polymeric, gels, synthetic muscle, bucky tubes
3. Control: Chapter 3
   (a) negative feedback, spinal stretch reflex, lower motor nuclei
   (b) Spring-Mass-Damper - harmonic oscillator, characteristic equation, natural frequency, damping ratio, stability, Lyapunov's Direct Method, the phase portrait
   (c) Linear Control, Laplace transform, BIBO, stability in the time domain, transfer functions, SISO filters, closed-loop transfer function, time domain solutions for controlled systems
   (d) Proportional-Derivative (PD) control, characteristic second-order responses (under-, over-, and critically-damped), amplitude and phase responses
   (e) *questions like those we practiced in the written homework assignments*
4. Kinematic Systems: Chapter 4
   (a) Terminology - links, joints, kinematic chain, mechanisms, prismatic 2P/3P mechanisms closed- and open-chain, degrees of freedom, configuration space
   (b) Spatial representation - homogeneous transforms (deriving, interpreting, composing, inverting)—*kinematic puzzles*
   (c) forward kinematics, inverse kinematics (workspace constraints), dextrous workspace, reachability
   (d) Visual Kinematics - pinhole camera model, perspective distortion, stereo reconstruction, disparity
   (e) Hand-Eye transformations
   (f) Jacobians - deriving the Jacobian from forward kinematic relations
   (g) Kinematic conditioning - eigenvalues and eigenvectors, principal kinematic transformations (velocity, force, precison, amplification relations),