

CMPSCI 403 Midterm II Review

F20

*focus on lecture and written homework problems,
refer to the book to clarify material*

Dynamics - Chapter 6.1, 6.2 (thru Eqn 6.3) 6.3, Appendix B.4.3

1. conservation of linear and rotational momentum, rotating coordinate systems, Newton-Euler equations, outward/inward iterations, Lagrangian gravity compensation, coriolis and centrifugal compensation, (coupled) inertial compensation
2. the computed torque equation,
 - (a) Feedforward compensation - linearized, de-coupled control.
 - (b) Simulation - dynamic model, integration, Roger
 - (c) Analysis - acceleration ellipsoid/polytope

Path Planning - Lavelle, Sections 1.2, 5.6, DORB 10.1.1, App. C

1. representing free space -
 - (a) configuration- and Cartesian-space,
 - (b) obstacle dilation, cellular decomposition, 2^n -tree
 - (c) Roadmaps - visibility graphs, Voronoi diagrams, Probabilistic Roadmap (PRM) (sample, select local goal, collision detect/local planner, graph building)
2. moving in freespace -
 - (a) Potential fields - local minima, navigation functions, harmonic functions
 - (b) lazy PRM, rapidly-expanding random trees (RRT)

Grasping - Chapter 5, Section 7.2

1. tactile sensing
 - (a) mechanoreceptors
 - (b) robot tactile sensors
2. screw systems
3. mobility analysis
4. form closure
5. the grasp Jacobian
 - (a) in twist and wrench domains
 - (b) contact types, the selection matrix, translating and rotating contact wrenches
 - (c) algebraic definition of the grasp Jacobian
 - (d) grasp Jacobian by inspection
6. force closure
7. solving for grasp forces