

ENEE 769R Principles and Algorithms for Collectives: from Biology to Robotics – (3 credits)

Grade Method: REG/AUD (fall 2012 MW 12:30-1:45pm, in room CSI 1122). This is an Advanced Topics Course in Control Systems. Prerequisite: MATH410 or equivalent, or permission of instructor.

Generalities: degrees of freedom problem; synergies; graphs and motifs; hierarchies. **Models of Individuals:** curves and frames; agent models on matrix Lie group $SE(n)$; manipulation and mobility; rigid body. **Models of Collectives:** agents and linkages (physical and informational); configuration space, symmetry and shape space; graphs and interconnection. **Goals and Tasks:** reach and grasp; product of exponentials formula; jacobians; Lie brackets and controllability; coverage; dynamics in shape space, relative equilibria. **Structure and Algorithms:** invariant manifolds; strategies and feedback laws; graphs and convergence; optimality; data from biological collectives; sampling and reconstruction.