

Course: EW452 Advanced Topics in Robotics

Credits: 3 credits – 2 recitation hours – 2 laboratory hours

Course Description: A follow-on to EW450 Introduction to Robotic Systems that introduces path and trajectory planning, probabilistic classification, neural networks, camera calibration, camera registration, and visual servoing. Students develop methods for target identification, motion prediction, and closed-loop tracking. Methods are applied during hands-on lab exercises and a multi-week final project using articulated robotic manipulators and machine vision cameras.

Pre-requisites: EW450 or Dept. Chair Approval

Course Coordinator: Prof. Mike Kutzer

Textbook: None

Course Objectives:

Compute, apply, and manipulate rigid body transformations;
Derive, utilize, visualize, and explain matrix representations of rotations in space;
Derive, utilize, visualize, and explain trajectories in three-dimensional space;
Derive, utilize, visualize, and explain trajectories in joint space;
Utilize, visualize, and explain affine transformations in two and three dimensions;
Utilize and explain camera calibration techniques;
Utilize and explain lens distortion models;
Derive, utilize, and explain the Jacobian for fixed camera and eye-in-hand visual servoing of articulated robots;
Utilize and explain vision features for object characterization; and
Utilize, and explain methods for object/pattern recognition (Bayes Theorem, artificial neural networks, etc.).

Topics:

Path Planning
Trajectory Planning
Naïve Bayes Classifiers
Decision Theory
Neural Networks
Backpropagation
Camera Calibration
Lens Effects
Camera Registration
Visual Servoing

Last Updated: 12-January-2021