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## Vision-Aided Navigation (086761) - Spring 2015

**Lecturer:** Assist. Prof. Vadim Indelman

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**Course Schedule:** Sundays, 14:30-17:30

**Room:** Aerospace 240

**Office Hours:** Tuesday, 14:30-16:30

**Course Website:**

- <http://vindelman.technion.ac.il/Teaching/2015-Spring/086761.html>
- <http://piazza.com/technion.ac.il/spring2015/086761/home>

## 1. Syllabus

Inertial and dead reckoning navigation, probabilistic information fusion, vision aided navigation (VAN), simultaneous localization and mapping (SLAM), 3D reconstruction, visual-inertial bundle adjustment (BA), cooperative navigation and SLAM, active state estimation and belief-space planning.

## 2. Grading Policy

**Homework assignments:** 30%

There will be 5-6 homework assignments combining theoretical and practical aspects covered in class. Each homework assignment will be given 2 weeks to complete. Assignments should be submitted before the lecture, i.e. before Sunday 14:30. Working in groups of two is acceptable and encouraged.

**Project:** 20%

The project will consist of reading scientific material (typically 1-2 papers), giving an oral presentation in class, and submitting a report. The project should be performed in groups of TBD students and be submitted by the last lecture.

**Final exam:** 50%

Homework and project grades will be taken into account only if exam grade is above 55.

## 3. Prerequisites

104034 Introduction to probability

086777 Estimation

## 4. Course Schedule

Course **tentative** weekly schedule (will probably change during the semester):

Week	Topic
1	Introduction, 3D rigid transformations and 6DOF poses, Dead reckoning
2	Probability basics, Bayesian inference, Extended Kalman filter
3	Projective camera geometry, Multiple view geometry
4	Structure from Motion I; Feature detection and matching
5	Structure from Motion II: Bundle adjustment
6	SLAM and VAN I
7	SLAM and VAN II
8	SLAM and VAN III
9	Cooperative navigation and SLAM
10	Cooperative navigation and SLAM
11	Active SLAM, Belief space planning
12	Project presentations, active SLAM, belief space planning
13	Project presentations

## 5. Textbooks

- [1] Farrell, Jay. Aided navigation: GPS with high rate sensors. New York: McGraw-Hill, 2008.
- [2] Thrun, Sebastian, Wolfram Burgard, and Dieter Fox. Probabilistic robotics. MIT press, 2005.
- [3] Hartley, Richard, and Andrew Zisserman. Multiple view geometry in computer vision. Cambridge university press, 2003.