UW EE P 592 Fall 2022 – Radar Signal Processing
Th 6:00pm – 9:50pm, ECE 269
Prof. Matt Reynolds, M 226 ECE, matt.reynolds@ece.uw.edu
Office Hours: TBD via Zoom, or by appointment

Course Summary

This course will provide a hands-on introduction to radar system design with an emphasis on radar signal processing. We will focus on emerging commercial and industrial applications for radar, such as automotive radar, short-range radar sensing for UAVs, and radar imaging.

Students will construct a low-power radar system using a software defined radio (SDR) approach and conduct a series of hands-on experiments including data collection and MATLAB/Python signal processing to demonstrate such applications as person tracking, automotive adaptive cruise control, UAV identification and classification via micro-Doppler signatures, and synthetic aperture radar (SAR) imaging.

Prerequisites

Basic knowledge of electromagnetics (EE 361) and signal processing (EE 242). For the experimental work, students should have a working knowledge of MATLAB or Python. Example code will be provided in MATLAB but students are welcome to program in Python if they prefer. Students will need to provide a Windows 10 laptop capable of running either MATLAB or Python.

Textbooks

Richards, Fundamentals of Radar Signal Processing 3rd Ed, McGraw Hill 2022. ISBN 978-1-260-46871-7. (Required)

Skolnik, Introduction to Radar Systems, 3rd Ed. McGraw Hill 2002. ISBN 0-07-288138-0 (Optional)

Grading

50% Homework Assignments (5 assignments)
50% Final Project (15 minute in-class presentation and "Conference Paper" report)
No final exam.

Homework Policy

Homework is due on paper or via timestamped PDF upload to Canvas at 6:00pm on the Thursday it is due. To be fair to everyone, the homework acceptance window closes at 6:00pm. **There will be no credit for late homework**, however your lowest homework score will be dropped.

Course Delivery Policy

In accordance with the Provost's "Expectations for autumn quarter instruction" issued September 15, 2022**, the course will be delivered in-person**. For maximum flexibility, and to accommodate student travel, illness, or other absences, lectures will be recorded and made available in real time via Zoom, and in video recording via Canvas on a best-efforts basis. PDF lecture notes will be posted to Canvas after each lecture.
https://www.washington.edu/coronavirus/2022/09/15/autumn-quarter-instruction/

Policy on Group Work and Academic Integrity

Preparation and delivery of Homework shall be individual effort. You are encouraged to study and consult with others, but all homework solutions must be your own. Any use of outside resources (e.g. assistance given by others, Web searches, other online resources) must be identified and annotated alongside your solution.

Preparation and delivery of Final Project shall be a team effort. A summary of the contributions of each team member to the Final Project shall be supplied as an addendum to the "Conference Paper" report.

At all times, students are expected to adhere to the University of Washington Student Code of Conduct, Washington Administrative Code (WAC) 478-121, and are expected to properly credit the work of others in all assignments and interactions with the instructor and other members of the class. Any suspected instances of academic misconduct will be reported in accordance with these policies.
https://www.engr.washington.edu/current/policies/academic-integrity-misconduct

Policy on Religious Accommodation

"Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/)."

Lec.	Date	Topic	Reading	Assignments
1	Th 9/29	Course Overview, the radar equation, key parameters	Richards Ch 1 Skolnik Ch 1	Syllabus Self-review on Engineering Units
2	Th 10/6	Radar transmitters, receivers, and antennas	Skolnik Ch 9/10 Richards Ch 2/3.8	Homework #1 Assigned
3	Th 10/13	Radar signal models	Richards Ch 2 Skolnik Ch 2	HW #1 due @ 6:00pm HW #2 Assigned
4	Th 10/20	Radar cross section and clutter	Richards Ch 2 Skolnik Ch 7	HW #2 due @ 6:00pm HW #3 Assigned
5	Th 10/27	Radar data structures Radar waveforms / matched filtering	Richards Ch 3.1-3.6 Richards Ch 4	HW #3 due @ 6:00pm HW #4 Assigned
6	Th 11/3	Doppler processing	Richards Ch 5	HW #4 due @ 6:00pm HW #5 Assigned
7	Th 11/10	Detection of signals in noise-thresholding and CFAR	Richards Ch 6	HW #5 due @ 6:00pm
8	Th 11/17	Synthetic aperture radar	Richards Ch 8	(work on final project)
	Th 11/24	*** Thanksgiving holiday - no lecture ***		
10	Th 12/1	Beamforming and STAP	Richards Ch 9	(work on final project)
11	Th 12/8	*** Last Class Period - Final Project Presentations ***		