

EEE 598: Advanced Topics in MIMO Wireless Communications  
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**Course Description:** Multiple-input multiple-output (MIMO) communication is a key theme of the current and future wireless systems. In MIMO communication, multiple antennas at the transmitter and/or the receiver are leveraged to provide additional spatial dimensions, and enhance the system rate and coverage. This course has two parts. In the first part, you will learn the signal processing and communication theory fundamentals of MIMO wireless communications. In the second part, we will explore the recent research directions in millimeter wave MIMO and massive MIMO, as well as their applications in autonomous/connected vehicles, drone communications, and virtual/augmented reality.

**Prerequisites:** A solid background in linear algebra is highly recommended. Familiarity with wireless communication fundamentals (on the level of EEE 558 - Wireless Communications or equivalent) is preferred.

### **Tentative Course Topics:**

#### Part I: Fundamentals of MIMO Communications

- MIMO discrete-time model
- MIMO channel modeling
- Single-user MIMO information theory
- Multi-user MIMO information theory
- Single-user MIMO with linear receivers
- Multi-user MIMO with linear receivers

#### Part II: Recent Research Directions

- Millimeter wave MIMO precoding
- Millimeter wave MIMO channel estimation
- Massive MIMO communications
- Machine learning aided MIMO communications
- Vehicular communications with MIMO
- Drone communications with MIMO
- MIMO communication for virtual/augmented reality

### **Textbook/Readings:**

No specific textbook is required. Some readings will be assigned from different books/papers.

**Course Organization:** Part I of the course (around 12 lectures) will focus on building the basics of MIMO wireless communications. Around 4 homework assignments (roughly one homework every two weeks) will cover this part of the course. Part II of the course, which follows the midterm exam, will explore the recent research directions in MIMO communications. Students,

in groups, will submit their research/survey project proposals after the spring break (around March. 12, 2018). The groups will develop their projects and final presentations will be delivered in the last week of the course. There will be no final exam for this course.

**Grading:**

Homework: 20%

Quizzes and participation: 5%

Midterm: 25%

Course project: 50%

- 10% project proposal
- 10% oral presentation
- 30% written project