Syllabus for Graduate Course

EE 87021: Advanced Topics in Random Wireless Networks

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1 Overview

This course provides an introduction to the theory of spatial point processes and random geometric graphs. These mathematical techniques will be applied to the stochastic analysis of large wireless networks. Specifically, we will study

- Stochastic geometry
- Point process theory
- Percolation theory
- The Probabilistic Method
- Random graphs
to analyze
- Interference
- Throughput
- Connectivity
- Coverage
- Capacity
- Secrecy
of large wireless systems.

Course webpage: http://www.nd.edu/~mhaenggi/ee87021/.

2 Course Goals

After completing this course, the student should:

- Understand research articles on the stochastic analysis of large wireless systems, for example the ones in the issue on Stochastic Geometry and Random Graphs for Wireless Networks of the IEEE Journal on Selected Areas in Communications.
- Have the background needed to conduct original research in that area, using analytical tools and simulation.

3 Software: The R Statistical Package

We will be using the Statistical Package R (in addition to Matlab). To download R, go to http://www.r-project.org/. Mac users can get the disk image from http://cran.stat.ucla.edu/bin/macosx/R-2.7.1.dmg, for example. We will need the spatstat package (and the ones it depends on).
4 Reading list (representative but incomplete)

5. V. Beffara and V. Sidoravicius, “Percolation theory”. 9 pages.
8. J. Ilow and D. Hatzinakos, “Analytic Alpha-Stable Noise Modeling in a Poisson Field of Interferers or Scatterers”.

As an introduction of the use of \( \mathbf{R} \) for the analysis of spatial point patterns, please refer to:

A. Baddeley, “Analysing spatial point patterns in \( \mathbf{R} \)”.

5 Tentative Schedule

<table>
<thead>
<tr>
<th>No class</th>
<th>Make-up class</th>
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</thead>
<tbody>
<tr>
<td>W Sep. 22</td>
<td>F Sep. 3</td>
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<tr>
<td>W Sep. 29</td>
<td>F Sep. 10</td>
</tr>
<tr>
<td>M Nov. 8</td>
<td>F Oct. 8</td>
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<tr>
<td>M Nov. 29</td>
<td>F Oct. 29</td>
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<tr>
<td>M Dec. 6</td>
<td>F Nov. 19</td>
</tr>
<tr>
<td>W Dec. 8</td>
<td>F Dec. 3</td>
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MW 3-4:15, except:

6 Grading

The grade will depend on participation in class, homework, a project, a midterm, and an oral final exam.