Faculty of Electrical Engineering
Advanced Topics in Probability and Stochastic Processes: 048929

SPATIAL STOCHASTIC PROCESSES

Winter semester, 2008/9

- **Instructor:** Robert J. Adler
- **Time:** Wednesdays, 16:30-18:30
- **Place:** Meir (EE) 353
- **Content:** Unlike standard courses in stochastic processes, which concentrate on processes which are a function of time, this course will concentrate on random functions defined over higher dimensional parameter spaces, such as the plane, three dimensional space, space-time, etc.

  The course will aim for breadth rather than depth (see the ambitious list of topics below) but each student will need to develop depth in at least one topic for an end of semester project/presentation.

- **Textbooks:** The material will come from a variety of sources, the two main ones being Tom Liggett's *Stochastic Interacting Systems: Contact, Voter, and Exclusion Processes* and my book-in-progress *Applications of Random Fields and Geometry, Foundations and Case Studies* with Jonathan Taylor and Keith Worsley.
- **Grade:** The final grade will (probably) depend on a combination of homework and presentations given by students at the end of the semester. The final structure will be determined by mutual agreement within the first two weeks of the semester.
- **Prerequisites:** Students will need a basic knowledge of stochastic processes and probability and some grounding in mathematical analysis, all at the graduate level.

COURSE OUTLINE

The following outline is not cast in stone: I will probably change it depending on who takes the course and what we turn out to be interested in, but it should give you an idea of to where we shall be heading.

Weeks	Topic
1-2	Point processes, and processes of lines and sets. Palm measures.
3	Integral geometry, stereology.
4	Gaussian and related random fields.
5	Brownian sheets and spatial martingales.

6	The multi-dimensional Rice formula and its applications.
7-8	Random field geometry. Random manifolds.
9	Spatial white noise and stochastic partial differential equations.
10-11	Interacting particle systems, contact and voter models, etc.
12	The Ising and other Hamiltonian models of Statistical Mechanics. The Markov property on lattices.
13	Continuum versions of lattice models. The Markov property in space.
14	Percolation.

ADDITIONAL INFORMATION

If you want extra information, you can reach me in the office at 8295957 (EE) or 8294503 (IE&M), at home at 8251794 (but not Shabbatot or Hagei Yisrael), or, most reliably, at robert@ieadler.technion.ac.il.

If you are reading this in hard copy rather than on the web, go to the Teaching section of my homepage to get the hyperlinks.