

9:30 am: James Lohner

Modeling Dielectric Breakdown with Diffusion-Limited Aggregation

9:50 am: Robert Ennis

Simulation of Curveball Pitch Motion

In a recent study, a right-handed ruleset was proposed to more easily describe the motion of a baseball pitch from the viewpoint of a pitcher. A computer simulation is used to test the validity of this model. The simulation's purpose is to arrive at more accurate conclusions with the use of a Runge-Kutta integration method (the original model used an Euler integration method). In addition to testing this model, we wish to compare the results from this work with those of a perceptual model being developed in the laboratory of Professor Arthur Shapiro, Professor of Psychology, Bucknell University. The final goal is to determine whether the "breaking" curveball, seen by many batters, is a result of the aerodynamics of the situation or some perceptual curiosity that is starting to be realized and explained.

10:10 am: Sarah Lewin

Simulation of a School of Fish

The phenomenon of animal aggregation and its causes are of interest to biologists, behavioral ecologists, and modeling theorists alike. The fascination is rooted in the relationship between individual animals and the subsequent animal interactions within a group. To understand how group patterns are affected by population size, we used an individual-based simulation model of fish movement in two dimensions. The simulation was conducted over populations of 2-20 individuals. A variety of metrics were used to quantify the results, which indicated that the group properties of the fish are very strongly influenced by the population size. These results shed light on which parameters best reproduce patterns observed in nature.

10:30 am: Ze Jiang

Modeling Faraday Waves

9:30 am: Austin Ziltz

Urban Traffic: A 2D Approach to Free-Flow and Grid-Lock

We study the influence of traffic lights and four-way stop signs on traffic flow using a two-dimensional model of urban traffic networks. We use a simple cellular automata model. The transition from states of free-flow traffic to grid-lock, are good indicators of the effect of the system parameters in conjunction with the chosen traffic control models. By controlling the traffic density, we have quantized the effect of the different methods of traffic control with average velocity and average cue length calculations.

9:50 am: Lindsey Appenzoller

Neural Networks, Memory, and Long-Range Connections

Higher level functions of the brain, i.e. memory and planning, are governed by connections between neurons and not the neurons themselves. We propose a model of a network of neurons that studies the formation and recall of memory. We assume that the population is living on a square lattice and initial stimuli are applied to the system. Each time a similar stimulus is applied to the system, the population of neurons exhibits correlated behavior. As the connections between neurons strengthen and random long-range connections are introduced, the system displays periodic behavior.

10:10 am: Beau Blumberg

Cellular Automaton Simulation of The Evacuation of a Room

Computer simulations have become a powerful tool in quantifying the ability to evacuate a given room. The basic movements of evacuees can be described quite accurately using a cellular automaton model; such a model accurately describes human behavior phenomenon such as panic. We examine one such model, wherein a room with one door is evacuated. The model also allows for impassable obstacles to be placed at fixed positions in the room. We study the amount of time needed to evacuate the room and its dependence on both the initial number of occupants in the room and the location and number of obstacles within the room.

10:30 am: Cragin Godley

Optimizing Path Finding With a Genetic Algorithm

9:30 am: Jason Maron

Propellant Trajectories in Electric Propulsion Device

The behavior of charged propellant in an electric propulsion device is examined in two-dimensions. We demonstrate that through the application of given potential biases surrounding the emitter, the electric potential within the emission channel relaxes to promote movement of the charged particle due to electric forces. For several charged particles we investigate their trajectories. We vary the initial positions of the particles and measure how dispersive the stream is when exiting the emitter.

9:50 am: Matthew Wheeler

Simulations with the Lennard-Jones Potential

A system of particles has been simulated in a box with periodic boundary conditions. We use molecular dynamics simulations using the Lennard-Jones potential to investigate the motion of each particle. The positions and velocities of each particle is randomized at the beginning. The kinetic and total energy is then measured over time. The results seem to agree nicely with experimental results and are a good demonstration of the accuracy of the Lennard-Jones potential.

10:10 am: Joshua Pierce

Dynamics of Price Equilibrium in a Simulated Market

My simple market simulation addresses the dynamics of "price equilibrium" under the theoretical axioms of "perfect competition." Specifically, the model simulates the profit-maximizing behavior of a producer in a competitive market in order to study the resulting market price as a function of market size, buyer's preferences, production costs and initial seller prices. When modeling the pricing strategy of a competitive producer, two different methods are used: a deterministic approach based on fixed production costs and quantities, and a stochastic approach based on a profit-maximizing algorithm of trial-and-error. After simulating these models across various market parameters, we find that the deterministic model mimics intuitive expectations of a competitive market, while the profit-maximizing producers of the stochastic model eventually work in unison to increment prices to the level of buyer's preferences.

10:30 am: Nga Nguyen

Population Dynamics of Three Species