Conference Program (final)

The 12th Israeli Mini-Workshop in Applied and Computational Mathematics

Time: Thursday December 31, 2009.
Place: Ben Gurion University Beer Sheva.
Location: Building No. 58 Room (-101).

(Supported by Center for Advanced Studies in Mathematics of Ben Gurion University).

Organizers: Vladimir Gol'dshtein, Raz Kupferman and Edriss S. Titi

Registration: naveof@cs.bgu.ac.il (050-420-4491)

This is the second announcement of the twelfth bi-annual meeting on "Applied and Computational Mathematics", which will take place on Thursday December 31, 2009 at Ben-Gurion University. These meetings debuted in 2003. The first eleven meetings have taken place in 6 different universities, see http://www.wisdom.weizmann.ac.il/~vered/wrkshpam.html.

Below, please find the list of speakers and the titles of their talks.

If you intend to present a poster, please send a confirmation note, **as soon as possible**, to Ophir Nave naveof@cs.bgu.ac.il.

10:15	**10:30**	**Coffee and Tea**	**Building no. 58 room (-101)**
10:30	10:40	**Opening**	
10:40	11:10	Leonid Berezansky, Ben Gurion University	On Local and Global Stability for Delay Equations of Mathematical Biology.
11:10	11:40	Claude Bardos, University of Paris 7	Loss of smoothness and energy conservation for the 3d Euler Equation.
11:40	12:10	Reuven Segev and Lior Falach, Ben Gurion University	Optimization in Stress Analysis and Load Capacity of Structures.
12:10	12:50	Poster oral presentaion	
13:00	**14:00**	**Lunch break**	**BON-APPETIT! (Knasim B Building)**
14:00	14:30	Raz Kupferman, Hebrew University	Incompatible elasticity and the immersion of non-flat Riemannian manifolds in Euclidean space.

		Jerusalem	
14:30	15:00	Koby Rubinstein, Technion	Reduced models for PDEs in narrow networks.
15:00	15:30	Jasmine Linshiz, Weizmann Institute of Science	Euler-alpha model.
15:30	**16:00**	**Coffee break and Posters session**	**Building no. 58 room (-101)**
16:00	16:30	Yoel Shkolnisky, Tel Aviv University	Cryo-EM structure determination by eigenvectors and semidefinite programming
16:30	17:00	Nadav Shnerb, Bar Ilan University	Coupled lattice maps, noise and extinctions.

Bon Voyage

Abstract

Loss of smoothness and energy conservation for the 3d Euler Equation.

Claude Bardos,
University of Paris 7

On Local and Global Stability for Delay Equations of Mathematical Biology.

Leonid Berezansky,
Ben Gurion University

We give a review on some recent results in stability theory for delay differential equations. These results bases on Bohl-Perron theory, oscillation theory and estimations of fundamental functions for this class of equations.

Incompatible elasticity and the immersion of non-flat Riemannian manifolds in Euclidean space.

Raz Kupferman,
Hebrew University Jerusalem

Euler-alpha model.

Jasmine Linshiz,

Weizmann Institute of Science

Reduced models for PDEs in narrow networks.

Koby Rubinstein
Technion

Cryo-EM structure determination by eigenvectors and semidefinite programming

Yoel Shkolnisky,
Tel Aviv University

Most algorithms for finding an initial 3D structure are based on the common lines property, which states that any two projections share a common line in Fourier space. A reliable detection of common lines is very difficult due to the low signal-to-noise ratio of the projection images. We describe two algorithms that recover the unknown imaging directions of all projections by minimizing a global self consistency function. In the first algorithm, the minimizer is obtained by computing the three largest eigenvectors of a specially-designed symmetric matrix derived from the common lines information. The second algorithm is based on semidefinite programming (SDP). The algorithms are shown to correctly find all orientations at very high noise levels, and are extremely fast, as they involve only the computation of a few top eigenvectors or a sparse SDP.Joint work with Amit Singer, Princeton University.

Optimization in Stress Analysis and Load Capacity of Structures.

Reuven Segev and Lior Falach,
Ben Gurion University

A body in stress analysis is modeled by Ω, a bounded open subset of $\Re^3$ having a Lipschitz boundary. It is assumed that the body is supported on an open subset Γ_0 of its boundary and that an external loading surface density vector field t_i acting on the complementary subset, Γ_t, of the boundary. The stress symmetric tensor field on the body, $\sigma_{ij}\ \ i,j=1,2,3$, satisfies the equilibrium equations and boundary conditions

$$\sum_j \frac{\partial \sigma_{ij}}{\partial x_j}=0, \text{ in } \Omega, \qquad \sum_j \sigma_{ij} n_j = t_i \text{, on } \Gamma_t, \quad i=1,2,3,$$

where *n* is the unit vector normal to the boundary. Since the stress tensor has 6 unknown components, the 3 equations above are not sufficient to determine a unique stress field and we denote the space of solutions by Σ_t. Engineering stress analysis is concerned with the maximum over Ω of $Y(\sigma(x))$, where Y is a norm or a semi-norm on the space of matrices describing the failure criterion for the material that makes up the body. In fact, for perfectly plastic materials, let $\pi(\tau)=\tau-(\tau_{11}+\tau_{22}+\tau_{33})I/3$, be the projection of the space of matrices on the space of matrices with zero trace, then, $Y(\tau)=|\pi(\tau)|$, for some norm $|\cdot|$ on the space of matrices. Thus, we consider the optimization problem

$$s_t^{opt} = \inf_{\in\Sigma_t} \|Y \circ \sigma\|^{\infty} .$$

It is shown that

$$s_t^{opt} = \sup_{w\in LD(\Omega)_0} \frac{\int_{\Gamma_t} |t\cdot w|\, dA}{\int_{\Omega} |\varepsilon(w)|^* \, dV}.$$

Here, for a vector field *w* on Ω, $\varepsilon(w)=(\nabla w+\nabla w^T)/2$, $|\cdot|^*$ is a norm dual to $|\cdot|$, $LD(\Omega)_0$ is the space of integrable vector fields *w* that satisfy the boundary conditions on Γ_0 and for which: $\varepsilon(w)$ are integrable, $\Sigma_i\, \partial w_i/\partial x_i = 0$. This vector space is equipped with the norm

$$\|w\| = \int_{\Omega} |\varepsilon(w)|^* \, dV$$

for which it is a Banach space. Furthermore, an optimal stress field always exists.

Using the failure criterion *Y* corresponding to the theory of plasticity, it turns out that an optimal stress field is attained in a plastic body if the yield stress s_Y is equal to s_t^{opt}. Next, we prove that for a plastic body, there is a maximal positive number, *C*, to which we refer as the load capacity ratio and which depends only on the geometry of Ω such that for any loading *t* on the boundary, the body will not collapse plastically (i.e.,there is a stress field σ equilibrating *t*, with $\|\sigma\|^{\infty} \le s_Y$) if $\|t\|^{\infty} \le s_Y C$ independently of the distribution of *t*. The load capacity ratio is given by

$$\frac{1}{C} = \sup_{w\in LD(\Omega)_0} \frac{\int_{\Gamma_t} |w|\, dA}{\int_{\Omega} |\varepsilon(w)|^* \, dV} = \|\gamma_D\|$$

Where $\gamma_D : LD(\Omega)_0 \to L^1(\partial\Omega, \Re^3)$ is the trace mapping on vector fields.

We will present the computations of *C* and computations of the worst case loading conditions corresponding to some examples of structures.

Coupled lattice maps, noise and extinctions.

Nadav Shnerb,
Bar Ilan University

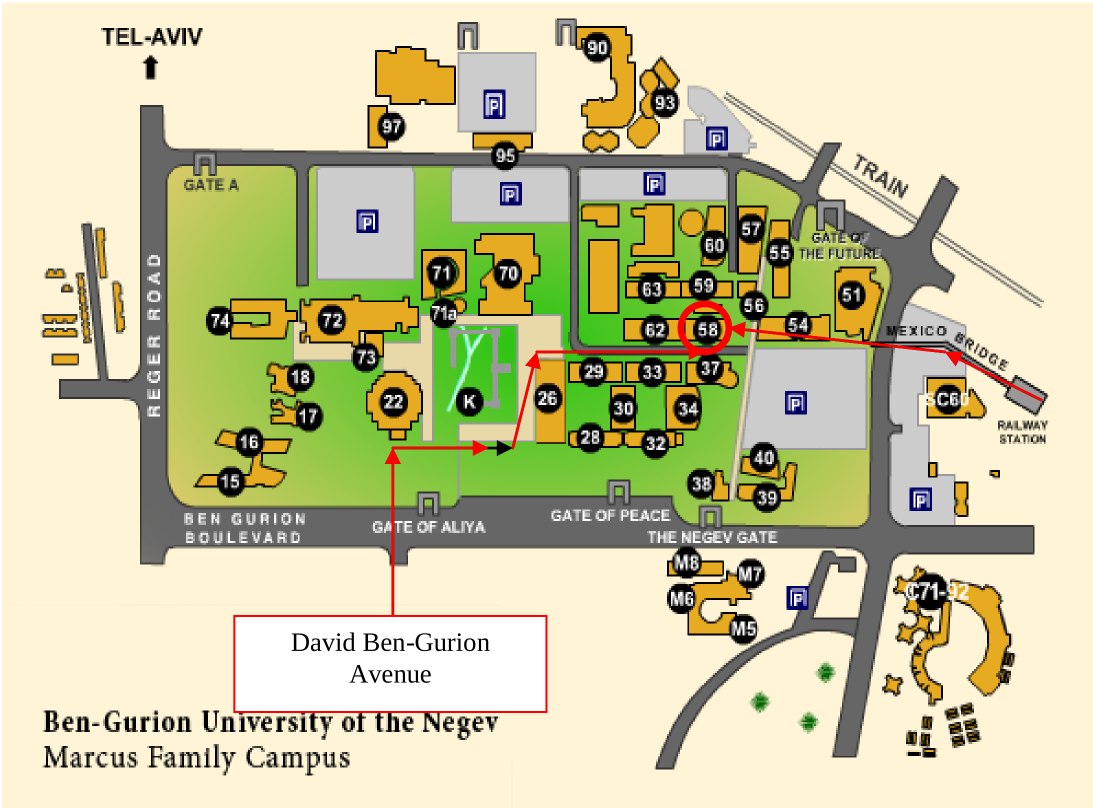
The effect of noise on a system of diffusively coupled chaotic maps is considered. Demographic stochasiticy is studied since it provides both noise and a natural definition for extinction. A two-step model is presented, where the intra-patch chaotic dynamics is followed by a migration step. The addition of noise to the already chaotic system is shown to change dramatically its behavior. The level of migration in which the system attains maximal sustainability is identified. This determines the optimal way to manipulate fragmented habitat in order to conserve endangered species.

Arrival

The link to the map of the campus is:

http://cmsprod.bgu.ac.il/home/virtualmapheb.html

In addition we add the campus map:



-Israel Railways information:

http://www.rail.co.il/EN/Pages/HomePage.aspx

For more information please contact to 03-5774000, 04-856444.

You should go down in Beer Sheva North University station, and go in to the campus through "Mexico bridge" .

Buses: "Egged company":

www.egged.co.il/Eng/

For more information please contact to 03-6948888.

You should go down in "Soroka Hospital" station

-רכבת ישראל מידע:

http://www.rail.co.il/HE/Pages/homepage.aspx

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