International Workshop on

Dynamical Systems

and

Applied Mathematics

on the occasion of the 60^{th} *anniversary of the birth of*

Professor Jerzy Ombach

15–16 October 2010

Conference venue:

Jagiellonian University
Faculty of Mathematics and Computer Science
Institute of Mathematics
Łojasiewicza 6, Kraków

Invited speakers:

Barnabas M. Garay (Budapest)
Peter E. Kloeden (Frankfurt am Main)
Kazuhiro Sakai (Utsunomiya)
Marek Grzegorzewski (Dęblin)
Adam Łomnicki (Kraków)
Piotr Oprocha (Murcia)

Organizing Committee:

Wojciech Słomczyński (chairman)
Marcin Mazur
Piotr Kościelniak
Joanna Orewczyk

The conference under the auspices of
Professor Karol Musioł,
Rector of the Jagiellonian University

Conference Schedule

Polish Session *Friday, 15 October*		
15:00–15:30	Wojciech Słomczyński	Czy zbiór lekarzy jest policzalny? - nasze przygody z *health manpower planning*
15:30–16:00	Adam Łomnicki	Trzy ciekawostki przyrodnicze
16:00–16:30	Marek Grzegorzewski Piotr Kościelniak	Matematyka w służbie nawigacji
16:30–17:00	Coffee break	
17:00–17:30	Andrzej Bielecki	Cień neuronu, czyli własność *shadowing* w dynamice sieci neuronowych
17:30–18:00	Marcin Mazur	Hiperboliczność obliczeniowa
18:00–18:30	Piotr Kościelniak	Własności C^0 typowe
English Session *Saturday, 16 October*		
10:00–10:15	Roman Srzednicki	Introductory word
10:15–11:00	Barnabas M. Garay	Two remarks on multivalued dynamical systems
11:00–11:45	Peter E. Kloeden	Random attractors and the preservation of synchronization in the presence of noise
11:45–12:30	Coffee break	
12:30–13:15	Kazuhiro Sakai	C^1-stably weakly shadowing homoclinic classes
13:15–14:00	Piotr Oprocha	Distributional chaos and topological dynamics

List of Abstracts (English Session)

Two remarks on multivalued dynamical systems

Barnabas M. Garay

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Abstract

[A.] Both in the discrete-time and in the continuous-time setting, the saddle structure near a hyperbolic equilibrium is preserved under convex compact valued Lipschitz perturbations with small Lipschitz constant. Stable and unstable sets of what the equilibrium is perturbed to are shown to be graphs of Lipschitz mappings. The proof relies heavily on results of Ornelas and Lojasiewicz on parametrizations of convex multifunctions.

[B.] Saito chaos generator, a widely studied two-parameter two-dimensional piecewise affine autonomous ordinary differential equation model for relay hysteresis is reconsidered and the transition between different types of chaos is explained. The main tool of investigation is a two-valued Poincaré mapping, the first return map with respect to a nonswitching line connecting two equilibria. By what we call concatenated arclength transformation, this Poincaré mapping is reduced to a single-valued piecewise smooth map for which standard Lasota-Yorke techniques apply.

References

[A.] G. Colombo, M. Feckan, B.M. Garay, Multivalued perturbations of a saddle dynamics, Diff. Eq. Dyn. Syst. 18 (2010), 29–56.

[B.] R. Csikja, B.M. Garay, J. Toth, Two-valued Poincare mappings in explaining chaos for planar systems with hysteresis, (in preparation).

Random attractors and the preservation of synchronization in the presence of noise

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Abstract

The long term behaviour of dissipatively synchronized deterministic systems is determined by the system with the averaged vector field of the original uncoupled systems. This effect is preserved in the presence of environmental i.e., background or additive noise provided stochastic stationary solutions are used instead of steady state solutions. Random dynamical systems and random attractors provide the appropriate mathematical framework for such problems and require Ito stochastic differential equations to be transformed into pathwise random ordinary differential equations. An application to a system of semi-linear parabolic stochastic partial differential equations with additive space-time noise on the union of thin bounded tubular domains separated by a permeable membrane will be considered. What happens with linear multiplicative noise will also be considered.

This a joint work with Tomas Caraballo (Sevilla) and Igor Chueshov (Kharkov). Based on the papers [1, 2].

References

[1] T. Caraballo, P.E. Kloeden, The persistence synchronization under environmental noise, Proc. Roy. Soc. London. A 461 (2005), 2257–2267.

[2] T. Caraballo, I. Chueshov, P.E. Kloeden, Synchronization of a stochastic reaction-diffusion system on a thin two-layer domain, SIAM J. Math. Anal. 38 (2007), 1489–1507.

Distributional chaos and topological dynamics

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Abstract

Let $f\colon X \to X$ be a continuous map acting on a compact metric space (X,ρ). For any positive integer n, points $x, y \in X$ and $t \in \mathbb{R}$ let

$$\Phi_{xy}^{(n)}(t) = \frac{1}{n}\left|\{i \ : \ \rho(f^i(x), f^i(y)) < t \quad , 0 \leq i < n\}\right|$$

where $|A|$ denotes the cardinality of the set A and denote by Φ_{xy} and Φ_{xy}^* the following functions

$$\Phi_{xy}(t) = \liminf_{n\to\infty} \Phi_{xy}^{(n)}(t) \quad , \quad \Phi_{xy}^*(t) = \limsup_{n\to\infty} \Phi_{xy}^{(n)}(t).$$

If there is an uncountable set $S \subset X$ so that $\Phi_{xy}(s) = 0$ for some $s > 0$ and $\Phi_{xy}^*(t) = 1$ for all $t > 0$, provided that $x, y \in S$, $x \neq y$, then we say that f is distributionally chaotic.

C^1-stably weakly shadowing homoclinic classes

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Abstract

Let f be a diffeomorphism of a closed n-dimensional C^∞ manifold, and p be a hyperbolic saddle periodic point of f. In this talk, we introduce the notion of C^1-stably weakly shadowing for a closed f-invariant set, and prove that for the homoclinic class $H_f(p)$ of p, if $f_{|H_f(p)}$ is C^1-stably weakly shadowing, then $H_f(p)$ admits a dominated splitting. Especially, on a 3-dimensional manifold, the splitting on $H_f(p)$ is partially hyperbolic, and if in addition, f is far from homoclinic tangency, then $H_f(p)$ is strongly partially hyperbolic. This is joint work with S. Gan and L. Wen.