LxDS Spring School 2025

28–30 May 2025

by **Telmo Peixe***

The *LxDS Spring School 2025* was held from 28 to 30 May 2025 at *ISEG–Lisbon School of Economics & Management*, Universidade de Lisboa. Organised by the Lisbon Dynamical Systems Group (LxDS), in partnership with CEMAPRE and CEMS.UL, the event focused on key developments in dynamical systems theory. It provided a platform for early-career researchers and students to deepen their understanding through advanced lectures delivered by leading international specialists.

Over the course of three days, participants engaged in three in-depth mini-courses led by distinguished invited speakers:

Daniel Peralta-Salas (ICMAT) presented *An Introduction to 3D Euler Flows*, exploring stationary solutions of the 3D Euler equations through a dynamical systems lens. The course revisited Arnold's structure theorem and analysed Beltrami flows—an especially rich family of steady-state solutions.

Joel Moreira (University of Warwick) gave a course on *Ergodic Ramsey Theory*, introducing the audience to Furstenberg's correspondence principle and its far-reaching implications in additive combinatorics. The lectures demonstrated how dynamical systems methods

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can resolve long-standing combinatorial problems, using accessible proofs that required no prior expertise in the subject.

Santiago Ibáñez (Universidad de Oviedo) delivered the course *Unfolding Chaos: Singularities of Vector Fields*, which focused on how certain singularities—especially of Hopf-Zero and nilpotent type—can underlie chaotic dynamics. The lectures provided both theoretical foundations and examples of global structures (e.g. Shilnikov homoclinic orbits) responsible for the onset of chaos.

The school welcomed approximately 25 participants, including MSc and PhD students, researchers, and academic staff from various Portuguese institutions, all sharing a common interest in dynamical systems.

Complementing the main courses, the school included a session of short research talks. The following abstracts were presented:

Bruno Gonçalves (Universities of Aveiro, Porto and Minho) described bifurcation phenomena and canard dynamics in FitzHugh-Nagumo systems, including evidence of mixed-mode and chaotic mixed-mode oscillations in coupled models.

Ana Rodrigues (University of Évora) presented recent results on the existence and renormalisation of invariant curves in piecewise isometries.

Davide Azevedo (University of Minho) discussed generic ergodicity of Sobolev homeomorphisms, proving that volume-preserving maps in certain Sobolev spaces generically exhibit ergodic and topologically transitive behaviour.

Kush Kinra (FCT Nova) investigated the optimal control of stochastic third-grade fluids, establishing well-posedness and optimality conditions via a reformulation of the original stochastic system.

Each abstract tackled different aspects of dynamical systems, from analytical models of excitable media and fluid dynamics to the ergodic properties of nonlinear transformations and renormalisation techniques in piecewise dynamics.

Generous funding from the *Centro Internacional de Matemática* (CIM) allowed the school to fully support travel, accommodation, and meals for PhD student participants. This financial backing was vital in ensuring their involvement and active participation throughout the event.

In summary, the *LxDS Spring School 2025* successfully brought together a vibrant group of students, researchers, and experts. The combination of advanced courses, original research presentations, and informal discussion fostered a dynamic and collaborative atmosphere. The event significantly contributed to the dissemination and development of current research in dynamical systems, reinforcing the importance of such initiatives within the mathematical community.

More information about the event can be found at https://sites.google.com/view/lxds-ss-2025/