Sébastien Motsch

Assistant Professor

Arizona State University
Mathematical & Statistical Sciences
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Research interests

- Mathematical biology (modeling self-organized dynamics)
- Data-model comparisons
- Multiscale modeling (derivation of macroscopic limits)
- Numerical methods for PDEs

Employment

2013–present **Assistant Professor**, *Arizona State University*.

2012–2013 **Postdoctoral Fellow**, *University of Texas/University of Maryland (CSCAMM)*, *KI-Net* program, supervised by **Irene Gamba** and **Eitan Tadmor**.

2009–2012 **Postdoctoral Fellow**, *University of Maryland (CSCAMM)*, *FRG* program: *Kinetic equations and complex systems*, supervised by **Eitan Tadmor**.

Education

2006–2009 **Ph.D.**, *University Paul Sabatier (UPS)*, Toulouse (France).
Title: *Mathematical modeling of animal displacements and derivation of macroscopic models*. Advisers: **Pierre Degond** (Mathematics Institute of Toulouse), **Guy Théraulaz** (Center for Research on Animal Cognition).

2005–2006 **Master 2 applied mathematics**, *UPS*, Toulouse, *summa cum laude*.

2004–2005 **Agrégation of mathematics**, *UPS*, Toulouse.

2003–2004 **Master 1 fundamental mathematics**, *UPS*, Toulouse, *summa cum laude*.

2002–2003 **License fundamental mathematics**, *UPS*, Toulouse, *summa cum laude*.

2000–2002 **Deug MIAS**, *UPS*, Toulouse.

Publications

[1] S. Motsch, D. Peurichard, *From short-range repulsion to Hele-Shaw problem in a model of tumor growth*, J. Math. Biol., (2017).

[2] P. Degond, M. Ferreira, S. Motsch, *Damped Arrow-Hurwicz algorithm for sphere packing*, J. Comput. Phys., 332(1):47-65 (2017).

[3] D. Armbruster, S. Motsch, A. Thatcher, *Swarming in Bounded Domains*, Physica D., 344(1):58–67 (2017).

[4] G. Dimarco, S. Motsch, *Self-alignment driven by jump processes: Macroscopic limit and numerical investigation*, Mathematical Models and Method in Applied Sciences, 26(7):1385–1410 (2016).

[5] I. Gamba, J. Haack, , S. Motsch, *Spectral method for a kinetic swarming model*, Journal of Computational Physics, 297:32-46 (2015).

[6] G. Baker, V. Yadav, S. Motsch,..., P. Lowenstein et al., *Mechanisms of Glioma Formation: Iterative Perivascular Glioma Growth and Invasion Leads to Tumor Progression, VEGF-Independent Vascularization, and Resistance to Antiangiogenic Therapy*, Neoplasia, 16(7):543-561 (2014).

[7] P-E. Jabin, S. Motsch, *Clustering and asymptotic behavior in opinion formation*, Journal of Differential Equations, 257(11):4165–4187 (2014).

[8] S. Motsch, E. Tadmor, *Heterophilious dynamics enhances consensus*, SIAM Review, 56(4):577–621 (2014).

[9] P. Degond, J-G. Liu, S. Motsch, V. Panferov, *Hydrodynamic models of self-organized dynamics: derivation and existence theory*, Methods and Applications of Analysis, 20(2):89–114 (2013).

[10] E. Boissard, P. Degond, S. Motsch, *Trail formation based on directed pheromone deposition*, Journal of Mathematical Biology, 66(6):1267–1301 (2013).

[11] S. Motsch, L. Navoret, *Numerical simulations of a non-conservative hyperbolic system with geometric constraints describing swarming behavior*, Multiscale Modeling and Simulation, 9(3):1253–1275 (2011) .

[12] S. Motsch, E. Tadmor, *A new model for self-organized dynamics and its flocking behavior*, Journal of Statistical Physics, Springer, 144(5):923–947 (2011).

[13] C. Appert-Rolland, P. Degond, S. Motsch, *Two-way multi-lane traffic model for pedestrians in corridors*, Networks and Heterogeneous Media, 6(3):351–381 (2011).

[14] P. Degond, S. Motsch, *A macroscopic model for a system of swarming agents using curvature control*, Journal of Statistical Physics, Springer, 141(4):685–714 (2011).

[15] P. Cattiaux, D. Chafai, S. Motsch, *Asymptotic analysis and diffusion limit of the Persistent Turning Walker Model*, Asymptotic Analysis, 67(1-2):17–31 (2010).

[16] J. Gautrais, C. Jost, M. Soria, A. Campo, S. Motsch, R. Fournier, S. Blanco, G. Theraulaz, *Analyzing fish movement as a persistent turning walker*, Journal of Mathematical Biology, 58(3):429–445 (2009).

[17] M. Herty, A. Klar, S. Motsch, F. Olawsky, *A smooth model for fiber lay-down processes and its diffusion approximations*, Kinetic and Related Models, 2(3):489–502 (2009).

[18] G. Bal, J. Garnier, S. Motsch, V. Perrier, *Random integrals and correctors in homogenization*, Asymptotic Analysis, 59(1):1–26 (2008).

[19] P. Degond, S. Motsch, *Continuum limit of self-driven particles with orientation interaction*, Mathematical Models and Method in Applied Sciences, 18(1):1193–1215 (2008).

[20] P. Degond, S. Motsch, *Large-scale dynamics of the Persistent Turning Walker model of fish behavior*, Journal of Statistical Physics, Springer, 131(6):989–1021 (2008).

Grants

2015–2018 NSF Applied Mathematics (#1515592), PI: *Characterizing spatio-temporal patterns of swarms*

Mentoring students

2017 - present **Dylan Weber**, *doctoral candidate*, Consensus on networks

2015 - present **Sarah El Jamous**, *doctoral candidate*, Modeling complex systems

2017 - present **Ryan Theisen**, *graduate student*, Social dynamics on graph

2017 - present **Michael Rozowski**, *graduate student*, Pattern formation

2016 - 2017 **Daniel Weser**, *graduate student*, Cross diffusion

2015 - 2016 **Shane Lubold**, *graduate student*, Optimal transport

2015 - 2016 **GuanLin Li**, *graduate student*, Opinion dynamics

Selected invited talks

Nov. 2017 **Workshop Kinetic Theory and Fluid Mechanics**, Toulouse, France

Oct. 2017 **Current trends in kinetic theory**, College Park, Maryland

Aug. 2017 **Pedestrian Dynamics: Modeling, Validation and Calibration**, ICERM, Providence

Jun. 2017 **Data-Driven Modeling of Collective Behavior**, SAMSI, North Carolina

Mar. 2017 **Dynamics and Geometry from High Dimensional Data**, Carnegie Mellon, Pennsylvania

Nov. 2016 **Transport phenomena in collective dynamics**, Zurich, Switzerland

May 2015 **Mathematical problems in kinetic theory**, Rennes, France

Mar. 2015 **High Performance and Parallel Computing Methods and Algorithms for Multiphase/Complex Fluids**, Singapore

July. 2014 **International conference on Hyperbolic problems: Theory, Numerics, Applications**, Rio, Brazil

Dec. 2013 **Classical and Quantum Mechanical Models of Many-Particle Systems**, Oberwolfach, Germany

Jul. 2013 **International conference on conservation laws**, Bangalore, India.

Feb. 2013 **Animal Swarms**, Kfar Blum, Israel.

Jan. 2012 **Emergent behaviour in multi-particle systems**, Banff, Canada.

Sep. 2012 **Populations & Crowds**, Los Angeles, California.

Feb. 2011 **Pedestrian Traffic Flows**, Research Triangle Park, North Carolina.

Nov. 2010 **PDEs in kinetic theories: kinetic description of biological models**, Edinburgh, Scotland.

Conference organizer

Apr. 2015 Co-organizer of the conference **Collective dynamics and model verification**, Tempe, Arizona.

Oct. 2014 Co-organizer of the conference **Modeling and Control in Social Dynamics**, Rutgers-Camden, New-Jersey.

Jul. 2014 Organizer of the mini-symposium **Kinetic models for multi-agent systems modeling socio-economic behavior** at the **AIMS conference on Dynamical systems**, Madrid, Spain.

Oct. 2013 Organizer of the conference **Young researchers workshop: Kinetic and macroscopic models for complex systems**, College Park, Maryland.

Jan. 2013 Co-organizer of the conference **Transport Models for Collective Dynamics in Biological Systems**, Raleigh, North-Carolina.

Nov. 2011 Organizer of the mini-symposium **Recent developments in self-organized dynamics** at the **SIAM conference on Analysis on PDEs**, San-Diego, California.

Memberships

2012–2018 Member of the **KI-Net** network (NSF), founded by Irene Gamba, Shi Jin and Eitan Tadmor

2011–2015 Member of the **MOTIMO** project (ANR-France), founded by Laure Blanc-Feraud, Pierre Degond, Xavier Druart, Franck Plouraboué and Eric Schmitt

Teaching experience

2013–present **Instructor**, *Partial Differential Equations*, *Ordinary Differential Equations*, *Linear algebra, Numerical analysis, Statistics*, Arizona State University

2010–2013 **Instructor**, *Advanced calculus, Differential equations*, University of Maryland

2009–2010 **Teaching Assistant**, *Calculus II*, University of Maryland

2006–2009 **Instructor**, *Calculus I-III* and *Introduction to numerical analysis (with Maple/Matlab)*, University of Paul Sabatier (Toulouse)

2005–2006 **Teaching Assistant**, *Calculus I*, University of Mirail (Toulouse)

2003–2004 **Instructor**, *high-school level*, Center CNFPT (Toulouse)

Skills

Language English, French (native language), Spanish (basic)

Programming Julia, Python, C/C++, Fortran, Matlab-Octave, R

Computer Linux (Ubuntu), Emacs, LaTeX, Git, Inkscape, Bash

Web Javascript, HTML/CSS, Wordpress