GEORGE MASON UNIVERSITY | Institute for Digital InnovAtion

College of Science

Thomas Wanner, PhD

Professor, Department of Mathematical Science

Education

PhD, Mathematics, University of Augsburg, Germany

Key Interests

Computational Topology | Dynamics of Partial Differential Equations | Random and Stochastic Dynamical Systems | Computer-Assisted Proofs | Phase Separation Phenomena

CONTACT

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Research Focus

My research is generally concerned with dynamical processes, as modeled for example by partial differential equations, as well as deterministic and stochastic dynamical systems. My research focus has been on models arising in materials science, and I have used topological as well as rigorous numerical tools to study their dynamics. In addition, I have developed and used tools for topological data analysis.

Current Projects

- Computer-assisted study of dynamical models. Focus is on their bifurcation structure and long-term dynamics. The methods are based on numerical computations, mathematical fixed-point theorems, and validation via interval enclosure methods.
- Development of combinatorial tools for the topological analysis of dynamical systems. Focus is on combinatorial vector fields and their generalizations, index theory, computational homology, and persistence.
- Topological data analysis of complex evolving patterns. Focus is on the use homology and persistence methods to develop topological signatures which can be used for pattern classification.

SELECT PUBLICATIONS

- P. O'Neil and T. Wanner. Analyzing the squared distance-to-measure gradient flow system with k-order Voronoi diagrams. *Discrete & Computational Geometry* 61(1), 91-119 (2019).
- T. Wanner. Computer-assisted bifurcation diagram validation and applications in materials science. *Proceedings of Symposia in Applied Mathematics, American Mathematical Society, Providence* (2018).
- T. Wanner. Topological analysis of the diblock copolymer equation. In: Y. Nishiura, M. Kotani (editors), *Mathematical Challenges in a New Phase of Materials Science, Springer proceedings in Mathematics & Statistics* 166, Springer-Verlag, (2016).