

Mustafa Taylan Şengül

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Current Position

Full Professor, Mathematics Department, Marmara University (2022–Present)

Education

2012 Ph.D. in Mathematics, Indiana University
2006 M.Sc. in Mathematics, Yeditepe University
2001 B.Sc. in Mathematics, Boğaziçi University

Areas of Specialization

- Pattern formations, bifurcations, transitions and reductions of dynamical systems
- Classical and geophysical fluid dynamics, hydrodynamic instabilities

Appointments Held

2022– Full Professor, Mathematics Department, Marmara University
2016–2022 Associate Professor, Mathematics Department, Marmara University
2015–2016 Assistant Professor, Mathematics Department, Marmara University
2014–2015 Assistant Professor, Mathematics Department, Yeditepe University
2012–2014 Visiting Assistant Professor, Mathematics Department, Purdue University
2007–2012 Associate Instructor, Mathematics Department, Indiana University
2001–2007 Associate Instructor, Mathematics Department, Yeditepe University

Publications

27. Şengül, Taylan, and Burhan Tiryakioğlu. “The Effect of Nonlinearities With Arbitrary-Order Derivatives on Dynamic Transitions.” *Mathematical Methods in the Applied Sciences*, early access, 2025.
26. Şengül, Taylan, Burhan Tiryakioğlu, and Esmanur Yıldız Akıl. “First transition dynamics of reaction-diffusion equations with higher-order nonlinearity.” *Studies in Applied Mathematics*, 153(3), 2024.
25. Efendiev, Messoud, Taylan Şengül, and Burhan Tiryakioğlu. “Two approaches to instability analysis of the viscous Burgers’ equation.” *Discrete and Continuous Dynamical Systems-S*, 17(4), 2024.
24. Şengül, Taylan, and Burhan Tiryakioğlu. “Interactions of (m, n) and $(m+1, n)$ modes with real eigenvalues: A dynamic transition approach.” *Communications in Nonlinear Science and Numerical Simulation*, 127, 2023.
23. Şengül, Taylan, and Burhan Tiryakioğlu. “Dynamic transitions and bifurcations of 1D reaction-diffusion equations: The non-self-adjoint case.” *Journal of Mathematical Analysis and Applications*, 523(1), 2023.
22. Şengül, Taylan, and Burhan Tiryakioğlu. “Dynamic transitions and bifurcations of 1D reaction-diffusion equations: The self-adjoint case.” *Mathematical Methods in the Applied Sciences*, 45(5), 2022.
21. Muntari, Umar Faruk, and Taylan Şengül. “Dynamic transitions and Turing patterns of the Brusselator model.” *Mathematical Methods in the Applied Sciences*, 45(16), 2022.
20. Chekroun, Mickael D., Henk Dijkstra, Taylan Şengül, and Shouhong Wang. “Transitions of zonal flows in a two-layer quasi-geostrophic ocean model.” *Nonlinear Dynamics*, 109, 2022.
19. Şengül, Taylan, and Esmanur Yıldız. “A dynamical systems approach to the interplay between tobacco smokers, electronic-cigarette smokers and smoking quitters.” *Chaos, Solitons & Fractals*, 146, 2021.
18. Şengül, Taylan. “Dynamical transition theory of hexagonal pattern formations.” *Communications in Nonlinear Science and Numerical Simulation*, 91, 2020.
17. Bozkurt, Deniz, Ali Deliceoğlu, and Taylan Şengül. “Interior structural bifurcation of 2D symmetric incompressible flows.” *Discrete & Continuous Dynamical Systems-B*, 25(7), 2020.
16. Lu, ChunHsien, Yiqiu Mao, Taylan Şengül, and Quan Wang. “On the spectral instability and bifurcation of the 2D quasi-geostrophic potential vorticity equation with a generalized Kolmogorov forcing.” *Physica D: Nonlinear Phenomena*, 403, 2020.
15. Esen, Oğul, Daozhi Han, Taylan Şengül, and Quan Wang. “On the nonlinear stability and the existence of selective decay states of 3D quasi-geostrophic potential vorticity equation.” *Mathematical Methods in the Applied Sciences*, 43(2), 2020.
14. Pan, Zhigang, Taylan Şengül, and Quan Wang. “On the viscous instabilities and transitions of a two-layer model with a layered topography.” *Communications in Nonlinear Science and Numerical Simulation*, 80, 2020.
13. Özer, Saadet, Taylan Şengül, and Quan Wang. “Multiple equilibria and transitions in spherical MHD equations.” *Communications in Mathematical Sciences*, 17(6), 2019.
12. Kieu, Chanh, Taylan Şengül, Quan Wang, and Dongming Yan. “On the Hopf (double Hopf) bifurcations and transitions of two-layer western boundary currents.” *Communications in Nonlinear Science and Numerical Simulation*, 65, 2018.
11. Şengül, Taylan, and Shouhong Wang. “Dynamic transitions and baroclinic instability for 3D continuously stratified Boussinesq flows.” *Journal of Mathematical Fluid Mechanics*, 20(3), 2018.
10. Özer, Saadet, and Taylan Şengül. “Transitions of spherical thermohaline circulation to multiple equilibria.” *Journal of Mathematical Fluid Mechanics*, 20(2), 2018.

9. Özer, Saadet, and Taylan Şengül. “Stability and transitions of the second grade Poiseuille flow.” *Physica D: Nonlinear Phenomena*, 331, 2016.
8. Liu, Honghu, Taylan Şengül, Shouhong Wang, and Pingwen Zhang. “Dynamic transitions and pattern formations for a Cahn-Hilliard model with long-range repulsive interactions.” *Communications in Mathematical Sciences*, 13(5), 2015.
7. Dijkstra, Henk, Taylan Şengül, Jie Shen, and Shouhong Wang. “Dynamic transitions of quasi-geostrophic channel flow.” *SIAM Journal on Applied Mathematics*, 75(5), 2015.
6. Şengül, Taylan, Jie Shen, and Shouhong Wang. “Pattern formations of 2D Rayleigh–Bénard convection with no-slip boundary conditions for the velocity at the critical length scales.” *Mathematical Methods in the Applied Sciences*, 38(17), 2014.
5. Şengül, Taylan, and Shouhong Wang. “Pattern formation and dynamic transition for magnetohydrodynamic convection.” *Communications on Pure and Applied Analysis*, 13(6), 2014.
4. Dijkstra, Henk, Taylan Şengül, and Shouhong Wang. “Dynamic transitions of surface tension driven convection.” *Physica D: Nonlinear Phenomena*, 247(1), 2013.
3. Şengül, Taylan, and Shouhong Wang. “Pattern formation in Rayleigh–Bénard convection.” *Communications in Mathematical Sciences*, 11(1), 2013.
2. Liu, Honghu, Taylan Şengül, and Shouhong Wang. “Dynamic transitions for quasilinear systems and Cahn-Hilliard equation with Onsager mobility.” *Journal of Mathematical Physics*, 53, 2012.
1. Şengül, Taylan. “An effective method for the existence of the global attractor of a nonlinear wave equation.” *Applied Mathematics E-Notes*, 7, 2007.

Talks at Conferences & Seminars

36. Joint with Esmanur Akıl Yıldız (presenter) and Burhan Tiryakioğlu. “The Exact Formulation of the First Transition Number in Nonlinear Reaction-Diffusion Equations”, ICAME’24, Ayvalık. (June 2024)
35. “Dynamic transitions of reaction-diffusion equations with higher order non-linearity”, Workshop on Nonlinear Systems IV, Gebze Technical University, Istanbul. (Jan 2024)
34. “Two approaches to instability analysis of the viscous Burgers’ equation”, Azerbaijan State University of Economics, Baku. (Oct 2023)
33. Joint with Bünyamin Kurtkaya (presenter), “Dynamics and Hopf bifurcation of a sustainable tourism model with time delay”, ICOMAA, Yıldız Technical University, Istanbul. (May 2023)
32. Joint with Betül Güdük İbrahimioğlu, “On the analysis of a model with Holling type-III functional response consisting of super predator, intermediate predator and prey”, ICPAM, Van. (June 2022)
31. “Doğrusal olmayan kısmi türevli denklemlerde geçişler ve desen oluşumları”, İstanbul University, Istanbul. (Apr 2022)
30. “Dynamic Transitions: Theory and Applications”, Workshop on Nonlinear Systems II, Gebze Technical University, Istanbul. (Sep 2020)
29. Joint with Merve Aygöl (presenter). “A bioeconomic differential algebraic predator–prey model with harvesting”, ICOMAA, Yıldız Technical University, Istanbul. (June 2020)
28. “Dinamik Geçiş Teorisi”, Colloquium Talk, İstanbul University, İstanbul. (Feb 2020)
27. “Stability and Transitions of Quasi-Geostrophic Equations”, Recent Advances in Fluid dynamics and Nonlinear Dynamics, Chengdu, China. (Jun 2019)

26. “Interior Structural Bifurcation of 2D Symmetric Incompressible Flows”, Workshop on Nonlinear Systems, Gebze Technical University, Istanbul. (Nov 2018)
25. “On the stability and transitions of quasi-geostrophic equations”, The International Conference on Applied Mathematics, Modeling and Life Sciences (ICAMLS), İstanbul. (Oct 2018)
24. “Stability and transitions of quasi-geostrophic equations”, Colloquium Talk, IZTECH, İzmir. (Mar 2018)
23. “Baroclinic Instability for 3D Boussinesq Flows”, 2017 Workshop on Nonlinear PDEs in Applied Mathematics, IZTECH, İzmir. (Aug 2017)
22. “Dynamic Transitions of the Baroclinicity for Continuously Stratified Boussinesq Flow”, Conference on Classical and Geophysical Fluid Dynamics: Modeling, Reduction and Simulation, Virginia University, Blacksburg. (Jun 2017)
21. “Dynamic Transitions in a Shear Flow Model”, The 8th International Workshop on Differential Equations and Applications, Dokuz Eylül University, İzmir. (Jun 2017)
20. “Transitions in Fluid Flows”, İstanbul Differential Equations Seminars, Istanbul. (Dec 2016)
19. “Transitions in Fluid Flows”, İstanbul Analysis Seminars, Istanbul. (Nov 2016)
18. “Kaos ve Dinamik Sistemler”, Marmara Fen Edebiyat Fakültesi 10. Bilim ve Kültür Günleri, Marmara University, Istanbul. (Oct 2016)
17. “Dynamic transitions for Geophysical Fluid Flows”, Colloquium Talk, Gebze Technical University, Istanbul. (Oct 2016)
16. “Pattern Formations and Dynamic Transitions in Hydrodynamic Instabilities”, 2. Marmara Matematik Günleri, Marmara University, Istanbul. (Oct 2016)
15. Joint with Henk Dijkstra, Jie Shen and Shouhong Wang, “Dynamic transitions of quasi-geostrophic channel flow”, The 11th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando. (Jul 2016)
14. “Dynamic transitions of quasi-geostrophic channel flow”, The 7th International Workshop on Differential Equations and Applications, Yaşar University, İzmir. (Jul 2015)
13. “Pattern Formations and Dynamic Transitions in Hydrodynamic Instabilities”, Colloquium Talk, Yeditepe University, Istanbul. (Nov 2014)
12. “Attractor Bifurcation and Dynamic Transitions in Rayleigh Benard Convection”, Colloquium Talk, Özyeğin University, Istanbul. (Feb 2014)
11. “Attractor Bifurcation and Dynamic Transitions in Rayleigh Benard Convection”, Colloquium Talk, Koç University, Istanbul. (Feb 2014)
10. “Pattern Formations for the 2D Rayleigh-Bénard Convection with No-Slip Boundary Conditions for the Velocity”, PDE Seminar, Indiana University, Bloomington. (Dec 2012)
9. “Pattern Formations for the 2D Rayleigh-Bénard Convection with No-Slip Boundary Conditions for the Velocity”, CCAM Seminar, Purdue University, West Lafayette. (Nov 2012)
8. Joint with Henk Dijkstra and Shouhong Wang, “Dynamic Transitions and Hexagonal Patterns in Surface Tension Driven Convection.”, AMS Joint Mathematics Meeting, Boston. (Jan 2012)
7. “Dynamic Transitions of Surface Tension Driven Convection”, Contributed Talk, “Incompressible Fluids, Turbulence and Mixing, In honor of Peter Constantin’s 60th birthday”, Carnegie Melon University, Pittsburgh. (Oct 2011)

6. “Dynamic Transition of Magnetic Convection”, PDE Seminar, Indiana University, Bloomington. (Jan 2011)
5. Joint with Henk Dijkstra and Shouhong Wang(presenter), “Dynamic Transitions and Hexagonal Patterns in Surface Tension Driven Convection”, European Geosciences Union General Assembly, Vienna. (Apr 2011)
4. Joint with Honghu Liu(presenter) and Shouhong Wang, “Phase Transition of Binary Systems”, AMS Meeting, Notre Dame/Indiana. (Nov 2010)
3. “Dynamic Transitions of Surface Tension Driven Convection”, Colloquium, Yeditepe University, Istanbul. (Jun 2010)
2. Joint with Shouhong Wang, “Dynamic Transitions for the MHD Equations”, AMS Sectional Meeting, Baylor University, Waco. (Oct 2009)
1. “Dynamic Transition Theory for Magnetohydrodynamic(MHD) Equations”, Colloquium, Boğaziçi University, Istanbul. (Aug 2009)

Service to the Profession

EDITORIAL BOARD MEMBER

- 2021–
2018–
- Mathematical Methods In The Applied Sciences
International Journal of Advances in Engineering and Pure Sciences.

Short Term Visits

- Summer 2016 Visiting Scholar, Mathematics Department, Indiana University
 Summer 2009 Visiting Instructor, Mathematics Department, Boğaziçi University
 Summer 2008 Visiting Instructor, Mathematics Department, Boğaziçi University

Conference Organizations

- 2017-2019 Marmara Matematik Günleri, organizing committee member, İstanbul.
 2018 The International Conference on Applied Mathematics, Modeling and Life Sciences (ICAMLS), organizing committee member, İstanbul.
 2018 The AIMS Conference, special session organizer, Taipei.
 2017 The International Conference on Applied Analysis and Mathematical Modeling (ICAAMM 2017), coordinator secretary, İstanbul, 2017.

Doctoral Thesis Directed

1. Umar Faruk Muntari, “Dynamic transitions and Turing patterns of reaction diffusion equations”, Marmara University, PhD, 2022.

Masters Thesis Directed

4. Bünyamin Kurtkaya, “Dynamics and Hopf Bifurcation of a sustainable tourism model with time delay”, Marmara University, MSc, 2024.

3. Merve Aygöl, “Dynamical systems approach to a bioeconomic differential algebraic predator–prey model with harvesting”, Marmara University, MSc, 2021.
2. Ceyda Akbaş, “A multi-strain SEIR outbreak model with general incidence rates: Application of the new Coronavirus Disease”, co-directed with Messoud Efendiev, Marmara University, Msc, 2021.
1. Esmenur Yıldız, “A dynamical systems approach to the interplay between tobacco smokers, electronic-cigarette smokers and smoking quitters”, co-directed with Saadet Özer, İstanbul Technical University, Msc, 2020.

Teaching Experience

- 2015-2024 *Marmara University Mathematics Department Undergraduate Level - Analysis 3, Analysis 4, Partial Differential Equations*
- 2015-2024 *Marmara University Mathematics Department Graduate Level - Linear Boundary Value Problems I, Nonlinear Dynamics and Chaos, Differential Equations and Dynamical Systems*
- 2015-2021 *Marmara University Engineering Faculty - Calculus I, Calculus 2, Differential Equations, Linear Algebra*
- 2014-2015 *Yeditepe University - Calculus I, II, III, Numerical Analysis.*
- 2012-2014 *Purdue University - Linear Algebra, Ordinary Differential Equations.*
- 2007-2012 *Indiana University - Finite Mathematics, Trigonometric Functions.*
- 2008-2009 *Boğaziçi University - Finite Mathematics, Calculus for Social Sciences.*

Awards, Honors, Projects and Fellowships

- 2015 - 2017 *Tübitak 2232 Fellowship (Project title: Transitions of geophysical flows)*
- 2011 *Indiana University William B. Wilcox Mathematics Award*
- 2008–2011 *National Science Foundation Graduate Student Fellowships*
- 2008 *Indiana University Robert E. Weber Memorial Award Honorary Mention*
- 2008 *Indiana University James P. Williams Memorial Award Honorary Mention*