Last name	First name	Institution	Title	Abstract
Berezovik	Irina	UT Dallas	BUILDING A MATHEMATICAL MODEL FOR SPREADING OF INFECTIOUS DISEASES IN MULTIPLE INTERACTING COMMUNITIES	The purpose of this project is to apply the equivariant topological degree method to building and studying the symmetric generalizations of the most recently developed epidemiological models of infectious diseases. The generalized models, in which we will be assuming that the interacting communities are identical, will be represented by systems of differential equations with symmetries. In particular, the investigator is interested in analyzing the oscillatory phenomena that may occur when an epidemic equilibrium is destabilized in such a multidimensional system, i.e. there is an appearance of a symmetric Hopf bifurcation. Periodicity of solutions is of the utmost importance to the researcher since it corresponds to the reoccurrence of epidemics, which may exhibit various symmetric properties/patterns. Using the equivariant degree method, the investigator to performs a direct analysis of such symmetric Hopf bifurcation problems. By computing the equivariant bifurcation invariants, the investigator provides the full classification of symmetric properties of the bifurcating branches (patterns), which will allow to make predictions for the existence of periodic solutions.
Bley	Gonzalo	University of Virginia	Estimates on Functional Integrals of Quantum Mechanics and Non-Relativistic Quantum Field Theory	and studying the symmetric generalizations of the most recently developed epidemiological models of infectious diseases. The generalized models, in which we will be assuming that the interacting communities are identical, will be represented by systems of differential equations with symmetries. In particular, the investigator is interested in analyzing the oscillatory phenomena that may occur when an epidemic equilibrium is destabilized in such a multidimensional system, i.e. there is an appearance of a symmetric Hopf bifurcation. Periodicity of solutions is of the utmost importance to the researcher since it corresponds to the reoccurrence of epidemics, which may exhibit various symmetric properties/patterns. Using the equivariant degree method, the investigator to performs a direct analysis of such symmetric Hopf bifurcation problems. By computing the equivariant bifurcation invariants, the investigator provides the full classification of symmetric properties of the bifurcating branches (patterns), which will allow to make predictions for the existence of periodic solutions. [1]
Bucaj	Valmir	Rice University	Some Extensions of the Discrete Kounz-Souillard Approach to Localization for Jacobi/Schrodinger Operators	We will discuss spectral properties of Jacobi operators. In particular, we prove: (1) that perturbing the diagonal coefficients of Jacobi operator, in an appropriate sense, results in exponential localization, and purely pure point spectrum with exponentially decaying eigenfunctions; and (2) we present examples of decaying potentials b_n such that the corresponding Jacobi operator has purely pure point spectrum. Finally, we will discuss analogous results for Schrodinger operators (i.e. when we take the off diagonal entries to be all 1s) in the case where we have less randomness present, a notion which we will make precise.

de Viana	Mikel	Georgia Institute of Technology	Construction of whiskered invariant tori for fibered holomorphic dynamics via reducibility and almost reducibility.	We consider fibered holomorphic dynamics generated by the skew product \begin{gather*} F: \mathbb{C}^n \times \mathbb{T}^d \longrightarrow \mathbb{C}^n \times \mathbb{T}^d\\ F(z, \theta) = (f(z, \theta), \theta + \omega) \end{gather*} which has as base the irrational translation T_{ω} on the torus $\mathbb{T}^d$. F has no fixed point nor a periodic orbit: The invariant object that organizes the dynamics is an invariant torus $K: \mathbb{T}^d \rightarrow \mathbb{C}^n$. Given an approximately invariant torus K_0, we construct an invariant torus K. The main technique is a KAM iteration in a-posteriori format. The asymptotic properties of the derivative cocycle $$A_{K_0}(\theta):= Df(K_0(\theta), \theta),$$ will play a crucial role. We assume that A_{K_0} is whiskered: There exists a splitting of $\mathbb{C}^n$ in stable, unstable and central directions which are approximately invariant under A_{K_0}. In the central directions, we use the ideas of reducibility or almost-reducibility for A_{K_0}. Here we also encounter the lack-of-parameters problem, which we solve using an idea due to Moser.
Do	Ngoc	Texas A&M University	Some graph models in nano-science and solid state	Graph model is proven in many cases to be much simpler to study than other approaches and yet preserves all essential ingredients of the dispersion relation. We study some spectral problems for periodic operators originating from mathematical physics. Using quantum graph model, we analyze the dispersion relation, and thus spectra, of periodic Schr\"odinger operators on a particular graphyne structure and its nanotubes. We found highly directional Dirac cones, which makes graphynes fascinating. We also study a conjecture, which has been widely assumed in solid state physics, for a class of periodic differential operators on graphs. Namely, we prove that extrema of dispersion relations of generic periodic differential operators on a class of discrete graphs are non-degenerate. (Here by non-degeneracy we mean extrema having non-degenerate Hessian.)
Herzig	Emily	University of Texas at Dallas	Axes of Rotation and Matrix Exponentials in Dimension Five	The exponential of a matrix, while often very useful, is generally difficult to compute exactly. We present an algorithm for finding in closed form the exact exponential of a 5×5 or 6×6 skew-symmetric matrix by utilizing, for $n = 5$ or 6, a double covering map from $Spin(n)$ to $SO(n)$ and novel representations of $spin(n)$. As part of our study on $SO(5)$, we also present a characterization of rotations in dimension five by locating the axis of rotation and identifying the hyperplane of rotation as a subspace of 4×4 matrices in a symplectic-type Lie algebra. Co-author: V. Ramakrishna
Hooton	Edward	University of Texas at Dallas	Sliding Hopf bifurcation in interval systems	In this talk, the equivariant degree theory is used to analyze the occurrence of the Hopf bifurcation under effectively verifiable mild conditions. We combine the abstract result with standard interval polynomial techniques based on Kharitonov's theorem to show the existence of a branch of periodic solutions emanating from the equilibrium in the settings relevant to robust control. The results are illustrated with a number of examples. Coauthors: Z. Balanov, W. Krawcewicz, D. Rachinskii
Jevtic	Filip	UT Dallas	Combinatorial structure of finite metric spaces	Given a finite metric space there is a convex polytope, called fundamental polytope, canonically associated to it. We present some progress toward understanding this connection.

Kravetc	Pavel	The University of Texas at Dallas	Pulsating dynamics of slow-fast population models with delay	Authors: Dmitrii Rachinskii, Andrei Vladimirov, Pavel Kravetc We discuss a bifurcation scenario which creates periodic pulsating solutions in slow-fast delayed systems through a cascade of almost simultaneous Hopf bifurcations. This scenario has been previously associated with formation of pulses in a delayed model of mode locked semiconductor lasers. In this work, through a case study of several examples, we establish that a cascade of Hopf bifurcations can produce periodic pulses, with a period close to the delay, in population dynamics models and explore the conditions that ensure the realization of this scenario near a transcritical bifurcation threshold. We derive asymptotic approximations for the pulsating solution and consider scaling of the solution and its period with the small parameter that measures the ratio of the time scales. The role of competition for the realization of the bifurcation scenario is highlighted.
Mallick	Anish	The Institute of Mathematical Sciences	Jaksic-Last Theorem for Higher Rank Perturbations	We consider the generalized Anderson Model $H^\omega=\Delta+\sum_{n\in\mathcal{N}}\omega_n P_n$, where $\mathcal{N}$ is a countable set, $\{\omega_n\}_{n\in\mathcal{N}}$ are i.i.d random variables and P_n are rank $N<\infty$ projections. For these models we prove theorem analogous to that of Jak\v{s}i\'{c}-Last on the equivalence of measures. We show that if the projection $Q_m^\omega P_n$ (where Q^ω_m is cannonical projection on the subspace generated by H^ω on range of P_m) has same rank as P_n, then the trace measure $\sigma_i(\cdot)=tr(P_iE_{H^\omega}(\cdot)P_i)$ and absolute continuous part of the measure $P_iE_{H^\omega}(\cdot)P_i$ are equivalent for $i=n,m$.
Silantyev	Denis	The University of New Mexico	Obtaining Stokes wave with high-precision using conformal maps and spectral methods on non-uniform grids	Denis Silantyev, Pavel Lushnikov Two-dimensional potential flow of the ideal incompressible fluid with free surface and infinite depth has a class of solutions called Stokes waves which is fully nonlinear periodic gravity waves propagating with the constant velocity. The increase of the scaled wave height H/L, where H is the wave height and L is the wavelength, from H/L= 0 to the critical value Hmax/L marks the transition from almost linear wave to a strongly nonlinear limiting Stokes wave. Fully nonlinear Euler equations describing the flow can be reformulated in terms of conformal map of the fluid domain into the complex lower half-plane, with fluid free surface mapped into the real line. This description is convenient for analysis and numerical simulations since the whole problem is now reduced to a single equation on the real line. We use spectral method together with an iterative scheme to obtain solutions. Extending solutions to the rest of the complex plane one can see that the distance Vc from the closest singularity in the upper half-plane to the real line goes to zero as we approach the limiting Stokes wave, which is the reason for the widening of the solution spectrum. This makes us seek a new approach that allows one to overcome this difficulty. We improve our numerical method drastically by introducing another conformal map that pushes the singularity higher into the upper half-plane and correspondingly shrinks the spectrum of the solution.
Titsworth	Matthew	University of Texas at Dallas	Fusion Categories and Geometric Invariants.	Fusion categories are fundamental to the mathematical study of topological phases of matter. Subsequently, the problem of classifying small fusion categories (up to monoidal equivalence) is important. We consider this problem from the perspective of geometric invariant theory and show that good quotient objects always exist and so there always exist geometric invariants which uniquely determine the equivalence class. In the case where the category is multiplicity free, there is a fast algorithm for computing a sufficient set of these invariants.

Wu	Hao-Pin	Department of Mathematical Sciences, University of Texas at Dallas	Bifurcation of periodic solutions in equivariant reversible FDEs: equivariant degree approach	Periodic solutions to symmetric networks of reversible functional differential equations (in short, SNRFDE) have been studied by many authors using different techniques. In this talk, we propose a method to study bifurcation of connected branches of periodic solutions to NRFDE based on the usage of the equivariant degree without free parameters. The motivating examples for the considered settings are coming from physics (space reversible systems and systems with non-local interaction), while equivariance reflects a symmetric character of the coupling in the corresponding network. Abstract results are supported by numerical examples respecting S_4-symmetries. To this end, several algorithms for the computation of $S_4 \times O(2)$-equivariant degree without parameter are developed.
Zhang	Bingsheng	Texas A&M University	On the solutions of two dimensional incompressible Navier-Stokes equations with constant energy and enstropy	It is not known if the global attractor of the space periodic 2D Navier-Stokes equations contains nonstationary solutions with their energy and enstropy per unit mass being constant in time. Such solutions, due to their hypothetical existence, are called "ghost solutions". In this work, we continue to introduce and study geometric structures shared by all the ghost solutions. This led us to consider a subclass of ghost solutions whose geometric structures have a supplementary stability property. A computational way to check the existence of these ghost solutions are provided. This is a joint work with Jing Tian.

[1] Responder updated this value.