First Congress of Greek Mathematicians
Special Session in Topology and its Applications
June 25-26, 2018

Organizers

Epaminondas Kechagias – Sofia Lambropoulou – Efstratios Prassidis

Time Schedule of Talks

	Monday, June 25		**Tuesday, June 26**
		09:00	Aneziris
		09:30	Lambropoulou
		10:00	Kodokostas
		10:30	Antoniou
17:00	Raptis		
17:30	Sereti		
18:00	Kechagias		

Speakers

Charilaos Aneziris (Intercontinental Exchange, US)
An algorithmic approach to Knot Tabulation

Using the Dowker notation for two-dimensional knot projections, we present a method that is used in the tabulation of knots. We discuss the challenges encountered in this projects, such as notations that are "undrawable" (do not correspond to actual knots), or distinct notations corresponding to equivalent knots. We continue with presenting the methods to overcome these challenges, and the results obtained. We then generalize the discussion to include links by using an extension of the Dowker notation that can apply to links with more than one components.

Stathis Antoniou (National Technical University of Athens)
Topological surgery in cosmic phenomena

Topological surgery is a mathematical technique used for creating new manifolds out of known ones. We observe that it occurs in natural phenomena where forces are applied and the manifold in which they occur changes type. Using Morse theory, we provide a way to formalize the temporal evolution of these processes. We apply this description to various phenomena exhibiting 1 and 2-dimensional surgery such as DNA recombination and the formation of Falaco solitons. We then propose the temporal evolution of 3-dimensional surgery as a new description of the formation of wormholes and black holes. We hope that through this study, topology and dynamics of many natural phenomena, as well as topological surgery itself, will be better understood.

Joint work with L. H. Kauffman and S. Lambropoulou.

Epaminondas Kechagias (University of Ioannina)
The Steenrod and Dyer-Lashof algebras as quotients

Steenrod introduced an algebra of cohomology operations which has been the most powerful tool for computations in algebraic topology. The so called Steenrod algebra turned out to be a Hopf algebra and that was the starting point for studying Hopf algebras

abstractly. Dyer and Lashof introduced an algebra of homology operations on infinite loop spaces. The so called Dyer-Lashof algebra provides the ingredient key for calculating the stable homotopy groups of spheres. In this introductory talk we will introduce a Hopf algebra which admits the Steenrod and Dyer-Lashof algebras as quotients and discuss their relationship along with their hom duals.

Dimitrios Kodokostas (National Technical University of Athens)
Rail isotopy

We propose a new kind of isotopy in usual euclidean 3-space considered equipped with two fixed parallel lines, its rails. Our isotopy is called rail isotopy and concerns two rail arcs, i.e. connected embedded curves with their endpoints on the rails (one point on each) and no other common points with them. The isotopy allows the rails to map onto themselves (although not necessarily pointwise) and the endpoints of the arcs to slide freely on the rails but prohibits other points of the arcs to touch the rails. We connect the notion of rail isotopy to the theory of knotoids, by considering the projections of the arcs on the plane of the two rails, and defining the notion of rail knotoid diagrams on this plane, and subsequently the notion of equivalent such diagrams, which we call as rail knotoids. Our main result assures that rail isotopy in space corresponds to rail equivalence on the plane. We also explore connections with the classical invariants associated to the usual equivalence relation on knot diagrams, like the Kauffman bracket polynomial.

Joint work with S. Lambropoulou.

Sofia Lambropoulou (National Technical University of Athens)
Knotoids, braidoids and applications

The theory of knotoids, which are open curves in oriented surfaces, is introduced by Turaev and it is a non-trivial extension of classical knot theory. Knotoids were further studied by Bartholomew and by Gügümcü and Kauffman. Recently, Gügümcü and SL introduced the counterpart theory of braidoids, which extends the classical theory of braids, and their topological interaction with knotoids. The theory of knotoids has also found important applications in the topological analysis of proteins (Goundaroulis, Dorier, Benedetti, Stasiak and Goundaroulis, Gügümcü, SL, Dorier, Stasiak, Kauffman). In this talk we will present some aspects of the theory of knotoids and of braidoids and we shall also discuss applications.

Georgios Raptis (Universität Regensburg)
Cobordism categories and algebraic K-theory of spaces

Waldhausen's algebraic K-theory of spaces (A-theory) is an extension of algebraic K-theory from rings to spaces (or ring spectra) which also encodes important homotopy-theoretic information about the spaces of diffeomorphisms of manifolds. In this talk, I will discuss some connections between A-theory and the theory of cobordism categories of smooth manifolds. More specifically, I will introduce a bivariant extension of the A-theory Euler characteristic of a smooth bundle and present a strong version of the Dwyer-Weiss-Williams smooth index theorem in this context. In addition, if time permits, I will also discuss some related work on the cobordism category of h-cobordisms.

Based on joint work with W. Steimle.

Fotini Sereti (University of Patras)
Small inductive dimension and universality on frames

The notion of universal frame, corresponding to the notion of universal space in topology, constructs a new chapter in frame theory which focuses on finding universal elements

in classes of frames. In this talk we prove that for a fixed ordinal α and a fixed infinite cardinal τ, in the class of all regular frames of weight less than or equal to τ with small inductive dimension less than or equal to α there exist universal elements.

Joint work with D. N. Georgiou, S. D. Iliadis, A. C. Megaritis.