TGTC 2020: TITLES AND ABSTRACTS

Recent progress on Four-dimensional Einstein manifolds

Xiaodong Cao (Cornell University)

Abstract: In this talk, I will discuss some recent progress in the study of 4-dimensional Einstein manifolds, and some progress on geometry of 4-manifolds in general. These are joint work with Hung Tran.

Stationary Surfaces for Curvature Functionals

Anthony Gruber (Texas Tech University-Costa Rica)

Abstract: The critical points of functionals which depend on the curvature invariants of an immersed surface often serve as idealized models for observable quantities such as surfactant films or material interfaces. Abstracting this idea, we consider the first variation of a generalized "bending energy" functional on surface immersions whose integrand depends smoothly on the mean and Gauss curvatures. Given appropriate boundary conditions, it is shown that the problem of determining the stationary surfaces for a curvature functional depends strongly on its behavior under uniform dilations, as well as whether or not these surfaces have rotational symmetry. This fact yields new consequences for free-boundary Willmore surfaces, as well as the critical points of any functional whose integrand depends analytically on the mean curvature.

Generalizing the Linearized Doubling Approach and New Minimal Surfaces and Self-Shrinkers via Doubling

Peter McGrath (U. Pennsylvania)

Abstract: I will discuss recent work (with N. Kapouleas) on generalizing the Linearized Doubling approach to apply (under reasonable assumptions) to doubling arbitrary closed minimal surfaces in arbitrary Riemannian three-manifolds without any symmetry requirements. More precisely, given a family of LD solutions on a closed minimal surfaces embedded in a Riemannian three-manifold, where an LD solution is a solution of the Jacobi equation with logarithmic singularities, we prove a general theorem which states that if the family satisfies certain conditions, then a new minimal surface can be constructed via doubling, with catenoidal bridges replacing the singularities of one of the LD solutions. The construction of the required LD solutions is currently only understood when the surface and ambient manifold possess O(2) symmetry and the number of bridges is chosen large enough along O(2) orbits. In this spirit, we use the theorem to construct new self-shrinkers of the mean curvature flow via doubling the spherical self-shrinker and new complete embedded minimal surfaces of finite total curvature in the Euclidean three-space via doubling the catenoid

Encoding knots by clasp diagrams

Jacob Mostovoy (CINVESTAV, Mexico)

Abstract: It is often thought that a knot is "generated" by its crossings much like a braid is written as a product of "half-twists". Pure braids have a better (in some ways) presentation in terms of "full twists" and, in fact, a similar encoding exists for knots. I will describe the analog of the Reidemeister theorem for this presentation of knots and indicate some possible applications. This is a joint work with Michael Polyak.

Invariant Surfaces in $\mathbb{S}^3$ based on Generalized Elastic Curves

Álvaro Pámpano (University of the Basque Country, Spain)

Abstract: We introduce a family of curvature energy functionals acting on planar curves of $\mathbb{S}^3$ which extend the classical notion of elastic curves. Critical curves of this family, usually referred as p-elastic curves, generalize other interesting families of curves such as critical curves of a functional studied by Blaschke.

Next, using these critical curves as generators, we describe two constructions of invariant surfaces in $\mathbb{S}^3$, binormal evolution surfaces and Hopf tori, which give rise to rotational linear Weingarten surfaces and closed tori critical for p-Willmore energies, respectively.

Finally, some properties of the critical generating curves are used to obtain results about the invariant surfaces.

Convergence of Manifold and Metric Spaces

Raquel Perales (UNAM)

Abstract: Since introducing Gromov-Hausdorff convergence in 1981, Gromov has relentlessly asked how various notions of curvature on Riemannian manifolds can be extended to notions on metric spaces and what notions of convergence can provide compactness theorems. In this talk we will deal with Intrinsic Flat convergence defined by Sormani and Wenger using work of Ambrosio and Kirchheim. This is a generalization of Federer and Fleming Flat convergence for currents. We will contrast both notions of convergence, i.e. Gromov-Hausdorff and Intrinsic Flat, and state several results concerning sequences of manifolds with uniform Ricci or Scalar curvature lower bounds. In particular, we will state several results in which both limits agree and stability results that only hold for Intrinsic Flat convence but not for Gromov-Hausdorff convergence.