Workshop on Submanifold Theory and Geometric Analysis

UFSCar, São Carlos, Brazil, August 05 – 09, 2019

Thursday- 8h - 8:50h -Auditório do DM

Yunelsy Nápoles Alvares

(IME/USP, Brazil)

PDE and hypersurfaces with prescribed mean curvature

Abstract. Minicourse 1

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Thursday- 9h - 9:50h -Auditório do DM

Joeri Van der Veken

(KU Leuven, Belgium)

Lagrangian submanifolds of the complex quadric

Abstract. The complex quadric Q^n is the complex hypersurface of complex $(n+1)$-dimensional projective space given in homogeneous coordinates by the equation $z_0^2 + z_1^2 + \ldots + z_{n+1}^2 = 0$. This manifold inherits a Kähler structure from the complex projective space, carries a family of non-integrable almost product structures and its curvature can be relatively easily described in terms of these two. Moreover, Q^n is the natural target space when considering the Gauss map of a hypersurface of a round sphere. In fact, such Gauss maps are related to minimal Lagrangian submanifolds of Q^n. We will discuss this relation – in particular for isoparametric hypersurfaces of spheres – and then study minimal Lagrangian submanifolds of Q^n, obtaining examples and some classifications, such as that of minimal Lagrangian submanifolds of Q^n with constant sectional curvature.

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Thursday- 10:30h - 11:20h -Auditório do DM

Jorge H. de Lira

(UFC, Brazil)

Mean curvature flow graphs and solitons in Riemannian products

Abstract. In this talk, we present some existence results for mean curvature flow of entire graphs in Riemannian products. If time permits, we will also discuss about mean curvature flow solitons in this same geometric setting.

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Thursday- 11:30h - 12h -Auditório do DM

Marcos P. Tassi

(UFSCar, Brazil)

Constant Anisotropic Mean Curvature Surfaces

Abstract. We talk about constant anisotropic mean curvature surfaces (CAMC surfaces), which arise as critical points (with or without restriction to variations that preserve volume) of the anisotropic area functional, given by the integral of a smooth function defined on the unit sphere and evaluated on the Gauss map. A particular case of CAMC surfaces occurs when the anisotropy function is identically equal to 1, corresponding to the minimal and constant mean curvature surfaces (CMC surfaces). As well as CMC surfaces, CAMC surfaces are also presented locally as graphs of solutions of an elliptical quasi-linear differential equation, which allows us to study them under the light of the Maximum Principle. We will present the introductory concepts of the theory and some results obtained, such as a Bernstein-type theorem for complete CAMC multi-graphs and uniform height estimates for CAMC graphs with planar boundary, with applications to the study of properly embedded surfaces with finite topology.

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Thursday- 14h - 14:40h -Auditório do DM

Alma L. Albujer

(Universidad de Córdoba, Spain)

Non-degenerate surfaces with the same Riemannian and Lorentzian mean curvature in a homogeneous space

Abstract. Let us consider the family of homogenous 3-manifolds with isometry group of dimension 4, $\mathbb{E}(\kappa,\tau)$. As it is well known, such manifolds are Riemannian fibrations over a 2-dimensional space form, the fibers are geodesics and there exists a one-parameter family of translations along the fibers, generated by a Killing field ξ. With an analogous definition, but in the case where the Killing field ξ is timelike, we get the Lorentzian homogeneous spaces $\mathbb{L}(\kappa,\tau)$.

Therefore, any non-degenerate surface Σ in $\mathbb{L}(\kappa,\tau)$ can be endowed with two different (non-degenerate) metrics, the ones induced by $\mathbb{L}(\kappa,\tau)$ and $\mathbb{E}(\kappa,\tau)$. And, consequently, we can define two different mean curvature functions on Σ, H_L and H_R respectively. We study some geometric properties of surfaces in $\mathbb{L}(\kappa,\tau)$ such that $H_L = H_R$.

Specifically, we prove that in the case where $H_L = H_R = 0$ those surfaces are ruled surfaces. This result extends a previous one by Kobayashi in the case $\kappa = \tau = 0$ and by Kim, Koh, Shin and Yang when $\tau = 0$. Furthermore, in this last case ($\tau = 0$) we study some properties and give some uniqueness results for the general case where $H_L = H_R$ not necessarily constant.

The results presented in this talk are part of a joint work with M. Caballero and with F. R. dos Santos.

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Thursday- 14:50h - 15:30h -Auditório do DM

Martha P. Dussan

(USP, Brazil)

Timelike Surfaces of the de Sitter space $\mathbb{S}^3_1(1) \subset \mathbb{R}^4$

Abstract. We present a method of describing all timelike surfaces in $\mathbb{S}^3_1(1)4$ using null coordinates and complex variable. We use also stereographic projection to identify necessary and sufficient conditions for lifting our timelike surfaces in $\mathbb{S}^3_1(1)$ into a special complex quadric of the complex projective space and then we study that surfaces. In particular we obtain a system of differential equations in termos of special complex functions which characterize minimal surfaces. We can solve the system explicitly. This work is joint Prof. Antonio Padua (IME-USP) and Martin Magid (Wellesley College).

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Thursday- 16h - 16:50h -Auditório do DM

Miguel A. Javaloyes

(Universidad de Murcia, Spain)

Submanifold theory in Finsler Geometry

Abstract. In this talk, we will describe basic results in the theory of submanifolds of Finsler manifolds. First, we will give some tools needed for this study. In particular, we will show that it is possible to define a Levi-Civita anisotropic connection associated with a Finsler metric. We will also show how to define the derivative of an anisotropic tensor (a tensor which depends on the direction rather than on the points of the manifold) and how to define the curvature tensor of an anisotropic connection, giving some results as Bianchi Identities and formulas relating the curvature of two different anisotropic connections. Next, we will study the curves that minimize the distance to a submanifold, showing that locally orthogonal geodesics are minimizers, and then we will study the Gauss equation of a submanifold. We will finish the talk speaking briefly about minimal submanifolds and the embedding problem.

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Thursday- 17h - 17:50h -Auditório do DM

Francisco C. Caramello Jr.

(IME/USP, Brazil)

Introduction to Orbifolds

Abstract. These are course notes, intended to survey the basics of orbifold theory, for the mini-course "Introduction to Orbifolds" held on the Workshop on Submanifold Theory and Geometric Analysis at Federal University of São Carlos, Brazil (August 05 – 09, 2019). We introduce orbifolds, relating them with group actions, then we see how elementary objects from Algebraic Topology generalize to orbifolds, such as the fundamental group and Euler characteristic, then we proceed to the generalizations of classical objects from Differential Geometry to orbifolds, studding orbibundles, differential forms, integration and De Rham cohomology, and finally we endow orbifolds with Riemannian metrics and survey some generalizations of classical results from Riemannian Geometry to this setting.

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