GEOMETRY WORKSHOP

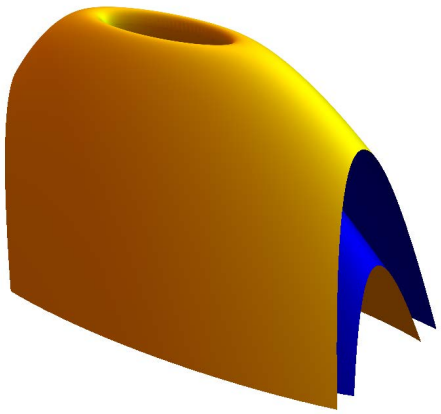
Wednesday, June 8. 2022, Matematicum, room 134, building 303B

Time	Speaker
10:00 – 10:45	Pacelli Bessa
11:00 – 11:45	Francisco Martin
12:00 – 13:00	Lunch
13:00 – 13:45	Vicent Gimeno
14:00 – 14:45	Sigmundur Gudmundsson
15:00 – 15:45	Niels Martin Møller
Ca. 18:00 –	Dinner

TITLES AND ABSTRACTS: P.T.O ⟼

- Pacelli Bessa, Departamento de Matemática
Universidade Federal do Ceara, Brasil:
Green Functions and the Dirichlet Spectrum
In this talk I will talk about the Green operator and the Dirichlet spectrum of bounded domains of Riemannian manifolds. More precisely, I will talk about four types of results.
(1) The iteration of the Green operator due to Sadao Sato to obtain the first Dirichlet eigenvalue of bounded domains
(2) The L^1-moment spectrum, the results here are related to the work of McDonald-Meyers and Hurtado-Markvorsen-Palmer.
(3) The radial spectrum of balls centred at the origin of model manifolds.
(4) Extrinsic volume of properly immersed minimal submanifolds and the Dirichlet spectrum.
The talk is going to be based on the joint work with V. Gimeno and L. Jorge: Green functions and the Dirichlet spectrum. *Rev. Mat. Iberoam. 36 (2020), no. 1, pp. 1–36. I will discuss the ideas without too much detail.*

- Francisco Martin, Universidad de Granada, Spain:
Translating annuli for the mean curvature flow
In this talk we will describe the construction of new examples of complete, properly embedded translating annuli in $\mathbb{R}^3$ which are contained in slabs, in particular they are not surfaces of revolution. Some of these translators, that we have called annuloids, look like two Delta-wings connected by a neck of a catenoid – see the figure below. We prove that these examples can be continuously deformed into other annuloids whose z-coordinate is unbounded from above, that we have called uncapped annuloids. Taking limit of these uncapped annuloids, as the neck size diverges, we are able to construct new simply connected translators (translating prongs) with interesting properties. This is a joint work with David Hoffman and Brian White.



MORE TITLES AND ABSTRACTS: P.T.O ⟼

- Vicent Gimeno, Universitat Jaume I, Castellon, Spain:
Topogonov's Theorem: Looking for shortcuts in Quantum Optics
Given several photons in an optical device, the evolution of the Quantum state is described by a unitary transformation. But not all unitary transformations can be related in such a way to an optical device. In this talk I will explain how to obtain an approximation for a unitary transformation of the state of a quantum system composed by several photons using an optical device. The key point in the construction of this approach is the well-known Topogonov Theorem in Riemannian Geometry. This is a joint work with J. C. Garcia-Escartin and J.J Moyano-Fernández published as Optimal approximation to unitary quantum operators with linear optics *in Quantum Information Processing (2021) 20:314.*

- Sigmundur Gudmundsson, Lunds Universitet:
Harmonic Morphisms, Proper Harmonic Functions – The Method of Eigenfamilies
Harmonic morphisms are maps $\phi : (M^m, g) \to (N^n, h)$ between Riemannian manifolds which preserve harmonic functions on the manifolds involved. In the late 1970s they were characterised, independently by B. Fuglede and T. Ishihara, as those harmonic maps which are horizontally conformal. This means that they are solutions to an over-determined non-linear system of partial differential equations. For this reason their existence theory becomes non-trivial. From the geometric point of view, the case when the codomain is a surface $(n = 2)$ is particularly interesting. Then each regular fibre of $\phi : (M, g) \to (N^2, h)$ is a minimal submanifold of (M, g) of codimension 2. This means that harmonic morphisms can be seen as a useful tool for constructing such interesting geometric objects. In the first part of this talk, we will describe connections with classical complex analysis and a certain duality to the theory of minimal surfaces in Euclidean 3-space. We will then introduce our notion of eigenfamilies of complex-valued functions on (M, g) and show how these can be employed to construct a wide collection of solutions to our over-determined non-linear problem on Riemannian Lie groups (G, g) and symmetric spaces $(G/K, g)$. The literature on biharmonic functions $f : (M, g) \to \mathbb{C}$ is vast, but with only very few exceptions the domains are either surfaces or open subsets of flat Euclidean space. The development of the last few years has changed this. We will describe how the above mentioned method of eigenfamilies gives p-harmonic functions on Lie groups and symmetric spaces for any $p > 1$.

- Niels Martin Møller, Københavns Universitet:
Wedge theorems for minimal surfaces and mean curvature flows
We show that so-called "wedge theorems" hold for all properly immersed, not necessarily compact, ancient solutions to the mean curvature flow in $\mathbb{R}^{n+1}$. Such nonlinear parabolic Liouville-type results add to a long story, generalizing our recent results for self-translating solitons, which in turn imply the minimal surface case (Hoffman-Meeks, '90) that contains the classical cases of cones (Omori '67) and graphs (Nitsche, '65). As an application, we classify the convex hulls of the spacetime tracks of all proper ancient flows, without any of the usual curvature or topology assumptions. The proofs make use of a linear parabolic Omori-Yau maximum principle for (non-compact) ancient flows. This is joint work with F. Chini.