UNIVERSITY OF COPENHAGEN

Young Geometers Meeting

April 19-23, 2021

GeoTop

Danmarks Grundforskningsfond
Danish National Research Foundation

CARLSBERG FOUNDATION

Contents

1 Schedule

The schedule is also available here (in iCal format):

`https://bit.ly/3uMnkny`

All times are given in *Coordinated Universal Time (UTC)*.

Time (UTC)	19.04. (Monday)	20.04. (Tuesday)
9:30 – 10:15	*Technical Q&A*	
11:00 – 11:45	Lindblad Petersen	Polymerakis
11:45 – 12:00	*– 15 min. break –*	
12:00 – 12:45	Kohout	Roncoroni
12:45 – 13:00	*– 15 min. break –*	
13:00 – 13:45	Barbaro	Fernández-Barroso
13:45 – 14:00	*– 15 min. break –*	
14:00 – 15:00	Schnürer	Dall'Acqua
15:00 – 15:30	*– 30 min. break –*	
15:30 – 16:30	Song	Schnürer
16:30 – 17:45	*– 75 min. break –*	
17:45 – 18:30	Martínez-Granado	Corro
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18:45 – 19:30	*Reception*	Ainasse

Time (UTC)	21.04. (Wednesday)	22.04. (Thursday)
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12:00 – 12:45	Papageorgiou	Minarčík
12:45 – 13:00	*– 15 min. break –*	
13:00 – 13:45	Onti	Wang
13:45 – 14:00	*– 15 min. break –*	
14:00 – 15:00	Dall'Acqua	Schnürer
15:00 – 15:30	*– 30 min. break –*	
15:30 – 16:30	Song	Dall'Acqua
16:30 – 17:45	*– 75 min. break –*	
17:45 – 18:30	*Poster Session*	Payne
18:45	*Virtual Walk*	
19:00	*Virtual SMK Tour*	

Time (UTC)	23.04. (Friday)
11:00 – 11:45	Prosanov
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12:00 – 12:45	Zeiser
12:45 – 13:00	*– 15 min. break –*
13:00 – 13:45	Souris
13:45 – 14:00	*– 15 min. break –*
14:00 – 14:45	Branding
14:45 – 15:15	*– 30 min. break –*
15:15 – 16:15	Schnürer

2 Lecture Series

Geometric flow equations

Oliver C. Schnürer
University of Konstanz

We will study hypersurfaces that solve geometric evolution equations. More precisely, we investigate hypersurfaces that evolve with a normal velocity depending on a curvature function like the mean curvature or Gauß curvature.

We will assume familiarity with hypersurfaces in Euclidean space, their metric, second fundamental form and some knowledge of partial differential equations, in particular parabolic equations and maximum principles.

Topics are:

- General introduction to the area.
- Evolution equations for geometric quantities like the metric and the second fundamental form.

- Convergence of convex hypersurfaces to round points. We will derive the crucial estimates by hand and and show how to use computer algebra for tedious calculations.

- The evolution of graphical hypersurfaces under mean curvature flow. After an overview on stability questions, we will introduce the concept of mean curvature flow without singularities.

On the elastic flow

Anna Dall'Acqua
Ulm University

In the Bernoulli model of an elastic rod described by a curve $f : I \to \mathbb{R}^n$, $n \geq 2$, the elastic energy is given by

$$E(f) = \int_I |\vec{\kappa}|^2 ds\,,$$

where $\vec{\kappa}$ is the curvature and s is the arc-length parameter. A natural approach to find minimisers is to study the associated steepest descent flow. Due to the behavior of the energy under scaling, one soon notices that the growth of the length of the curve should be penalized (alternatively one could impose that the length does not change).

In the lectures we will present a general approach to prove long time existence of the solutions and their asymptotic behavior for closed and open curves. One may consider curves with values in the Euclidean space or more general in a manifold with constant curvature. We will then look at the case of networks: i.e. several curves joint at points (junction points) that might move during the evolution. We study under which conditions the evolution keeps the topology of the networks and under which conditions one can still expect long time existence of the solutions. In the last lecture we make a connection to the steepest descent flow of the Willmore energy

$$W(f) = \int_\Sigma |\vec{H}|^2 d\mu\,,$$

for tori of revolution. Here $f : \Sigma \to \mathbb{R}^3$ is an immersion, $\vec{H}$ the mean curvature vector and μ the induced area measure.

On some analogies between minimal surfaces and Einstein 4-manifolds

Antoine Song
Berkeley

Minimal surfaces are embedded surfaces in 3-manifolds, whose mean curvature vanishes. Eintein 4-manifolds are defined by the fact that their Ricci curvature is proportional to the metric. At first glance they seem to be very different objects, however

they in fact share many geometric and analytic properties.

I will introduce these objects and try to emphasise the analogies between them, by comparing several classical results. I will then discuss some recent quantitative results relating topology and geometry for these two classes of objects.

3 Contributed Talks

Monday, April 19

Compact Cauchy horizons in vacuum spacetimes

— 11:00 UTC —

O. Lindblad Petersen
Stanford

Moncrief and Isenberg conjectured in 1983 that any compact Cauchy horizon in a smooth vacuum spacetime is a smooth Killing horizon. We present a proof of this conjecture, under the assumption that the surface gravity of the horizon is a non-zero constant. One main ingredient in the proof is a new unique continuation theorem for wave equations through compact horizons.

Non-uniqueness of limits for geometric flows

— 12:00 UTC —

J. Kohout
Oxford

In the study of geometric flows it is often important to understand when a flow which converges along a sequence of times going to infinity will, in fact, converge along every such sequence of times to the same limit. While examples of finite dimensional gradient flows that asymptote to a circle of critical points show that this cannot hold in general, a positive result can be obtained in the presence of a Lojasiewicz-Simon inequality. In this talk I will introduce this problem of uniqueness of limits and discuss joint work with Melanie Rupflin and Peter M. Topping in which we examined the situation for a geometric flow that is designed to evolve a map describing a closed surface in a given target manifold into a parametrization of a minimal surface.

References

[1] James Kohout, Melanie Rupflin, and Peter M. Topping. *Uniqueness and nonuniqueness of limits of Teichmüller harmonic map flow*, *Advances in Calculus of Variations* (2020).

Griffiths Positivity for Bismut Curvature and its Behaviour along Hermitian Curvature Flows

— 13:00 UTC —

G. Barbaro
La Sapienza University of Rome

In this note we study a positivity notion for the curvature of the Bismut connection; more precisely, we study the notion of *Bismut-Griffiths-positivity* for complex Hermitian non-Kähler manifolds. Since the Kähler-Ricci flow preserves and regularizes the usual Griffiths positivity we investigate the behaviour of the Bismut-Griffiths-positivity under the action of the Hermitian curvature flows. In particular we study two concrete classes of examples, namely, linear Hopf manifolds and six-dimensional Calabi-Yau solvmanifolds with holomorphically-trivial canonical bundle. From these examples we identify some HCFs which do not preserve Bismut-Griffiths-non-negativity.

References

[1] Giuseppe Barbaro. *Griffiths positivity for Bismut curvature and its behaviour along Hermitian Curvature Flows* (Feb. 2021). arXiv: 2102.06637 [math.DG].

Geodesic currents and the smoothing property

— 17:45 UTC —
D. Martínez-Granado
UC Davis

Geodesic currents are measures that realize a closure of the space of curves on a closed surface. Bonahon introduced geodesic currents in 1986, showed that geometric intersection number extends to geodesic currents and realized hyperbolic length of a curve as intersection number with a geodesic current associated to the hyperbolic structure. Since then, other functions on curves have been extended to geodesic currents: negatively curved metrics with cone singularities (Hersonsky-Paulin, 1997), word length of simple generating sets of a surface group (Erlandsson, 2016) or stable length (Erlandsson-Parlier-Souto, 2016). In this talk we present results giving conditions on a function on curves to extend continuously to geodesic currents and subsuming previous results. We also obtain an extension to geodesic currents for the extremal length of curves. This is joint work with Dylan Thurston.

References

[1] Dídac Martínez-Granado and Franco Vargas Pallete. *Comparing hyperbolic and extremal lengths for shortest curves* (Nov. 2019). arXiv: `1911.09078 [math.GT]`.

[2] Dídac Martínez-Granado and Dylan Thurston. *Currents and intersections* (2021). in preparation.

[3] Dídac Martínez-Granado and Dylan P. Thurston. *From curves to currents* (Apr. 2020). arXiv: 2004.01550 [math.GT].

Tuesday, April 20

Liouville type properties of covering spaces

— 11:00 UTC —

P. Polymerakis
Max Planck Institute for Mathematics

In this talk, we will survey some results on the relation between the fundamental group of a closed Riemannian manifold and the validity of certain Liouville type properties on the universal covering space. More precisely, we will focus on the Liouville property (non-existence of non-constant bounded harmonic functions), the strong Liouville property (non-existence of non-constant positive harmonic functions), and the finite dimensionality of the spaces of harmonic functions of polynomial growth of fixed degree. The proposed talk is based upon the following:

References

[1] Werner Ballmann and Panagiotis Polymerakis. *Equivariant discretizations of diffusions and harmonic functions of bounded growth* (Feb. 2020). arXiv: 2002.03835 [math.DG].

[2] Werner Ballmann and Panagiotis Polymerakis. *Equivariant discretizations of diffusions, random walks, and harmonic functions* (June 2019). arXiv: 1906.11716 [math.DG].

[3] Panagiotis Polymerakis. *Positive harmonic functions on groups and covering spaces*, English, *Advances in Mathematics* **379** (2021). Id/No 107552, p. 9.

Symmetry Results for Critical p-Laplace Equations

— 12:00 UTC —
A. Roncoroni
Universidad de Granada

We consider the following critical p-Laplace equation:

$$\Delta_p u + u^{p^*-1} = 0 \quad \text{in } \mathbb{R}^n\,, \tag{3.1}$$

with $n \geq 2$ and $1 < p < n$. Equation (3.1) has been largely studied in the PDE's and geometric analysis' communities, since extremals of Sobolev inequality solve (3.1) and, for $p = 2$, the equation is related to the Yamabe's problem. In particular it has been recently shown, exploiting the moving planes

method, that positive solutions to (3.1) such that $u \in L^{p^*}(\mathbb{R}^n)$ and $\nabla u \in L^p(\mathbb{R}^n)$ can be completely classified. In the talk we will consider the anisotropic critical p-Laplace equation in convex cones of $\mathbb{R}^n$. Since the moving plane method strongly relies on the symmetries of the equation and of the domain, in the talk a different approach to this problem will be presented. In particular this approach gives a complete classification of the solutions in an anisotropic setting. More precisely, we characterize solutions to the critical p-Laplace equation induced by a smooth norm inside any convex cone of $\mathbb{R}^n$.

This is a joint work with G. Ciraolo and A. Figalli.

On inaudibility of geometric properties related with the Jacobi operator on closed Riemannian manifolds

— 13:00 UTC —

J. M. Fernández-Barroso
University of Extremadura

A geometrical property is said to be audible if it can be determined from the eigenvalues of the Laplace–Beltrami operator. In this sense, there are audible properties, for example the volume of the manifold or the total scalar curvature. On the hand, there are properties which have been proved to be inaudible, this is the case of the D'Atri property, which is a generalization of the locally symmetry in the sense that the

local geodesic symmetries are volume preserving, up to sign. Equivalently, D'Atri spaces was characterize by the Ledger conditions. These conditions are related with the Riemannian curvature operator and more precisely, with the trace of the Jacobi operator and its covariant derivatives. Another inaudible symmetric-like property is the type $\mathcal{A}$ property, this is $(\nabla_X \mathrm{Ric})(X, X) = 0$, where Ric is the Ricci tensor given by the trace of the Jacobi operator.

In our work, we continue studying the audibility of geometric properties related with the Jacobi operator on closed Riemannian manifolds.

This is a joint work with Teresa Arias-Marco.

Quarter pinched spherical space forms bundles and Ricci flow

— 17:45 UTC —

D. Corro
UNAM

In this talk we consider $E \to B$ be a smooth bundle with fiber an n-dimensional spherical space form $\mathbb{S}^n/\Gamma$. We present some conclusions about the structure group of the bundle $E \to B$ when each fiber carries a metric of constant sectional curvature, and this metric depends continuously on the base point of the fiber.

More generally, we will see that in the case when each fiber carries a Riemannian metric of positive pointwise strongly

1/4-pinched sectional curvature, which varies continuously with respect to its base point, then we can apply a fiber-wise Ricci flow to get a metric of constant sectional curvature on the fibers.

This is joint work with A. K. Garcia-Perez, M. Günther, J.-B. Kordaß.

References

[1] Diego Corro et al. *Bundles with even-dimensional spherical space form as fibers and fiberwise quarter pinched Riemannian metrics* (Apr. 2020). arXiv: 2004.02518 [math.GT].

A Twisted Complex Brunn-Minkowski Theorem

— 18:45 UTC —
E. M. Ainasse
Stony Brook

In [1], Berndtsson proved a Nakano-positivity result on the curvature of holomorphic Hilbert bundles using Hörmander's classical theorem on L^2–estimates for the $\bar{\partial}$-operator. Using a variant of Hörmander's theorem, we show that the same result holds under different curvature assumptions. This is of particular interest when the manifold admits a negative plurisubharmonic function, as these curvature assumptions

allow for some curvature negativity. This new Nakano-positivity result can be used to prove log-plurisubharmonic variation results for general Stein manifolds, under the same weaker curvature positivity assumptions.

References

[1] Bo Berndtsson. *Curvature of vector bundles associated to holomorphic fibrations*, English, *Annals of Mathematics. Second Series* **169**, no. 2 (2009), pp. 531–560.

Wednesday, April 21

Discrete surfaces via cyclic systems

— 11:00 UTC —
G. Szewieczek
University of Vienna

A 2-dimensional congruence of circles in 3-space is called cyclic if it admits a 1-parameter family of smooth orthogonal surfaces. Classical geometers deeply investigated the relation between the geometry of those circle congruences and their orthogonal surfaces. In particular, it was pointed out how special cyclic congruences provide orthogonal surfaces of various integrable surface classes.

In this talk we shall discuss a discretization of cyclic systems and show how these systems can be used to construct discrete surfaces. In particular, starting with suitable discrete R-congruences, we demonstrate how to obtain discrete Dupin cyclides and discrete flat fronts in hyperbolic space as orthogonal surfaces of cyclic circle congruences.

The talk is based on the following two works:

[1] U. Hertrich-Jeromin and G. Szewieczek. *Discrete cyclic systems*. in preparation.

[2] Thilo Rörig and Gudrun Szewieczek. *The Ribaucour families of discrete R-congruences*, *Geometriae dedicata* (Apr. 2020). accepted. arXiv: `2004.04447 [math.DG]`.

Oscillating multipliers on symmetric and locally symmetric spaces

— 12:00 UTC —
E. Papageorgiou
University of Crete

Noncompact symmetric spaces are generalizations of hyperbolic geometry. As Riemannian manifolds, they are quotients of a connected, noncompact semisimple Lie group with finite center, modulo its maximal compact subgroup. Their rich geometric and algebraic structure provides powerful analytic

tools, such as spherical Fourier analysis and the Kunze-Stein phenomenon. In this context, we treat oscillating multipliers

$$T_{\alpha,\beta} = (-\Delta)^{-\beta/2} e^{i(-\Delta)^{\alpha/2}},\ \alpha, \beta > 0,$$

related to the Laplace-Beltrami operator $-\Delta$. We prove L^p boundedness of oscillating multipliers on symmetric spaces of noncompact type of arbitrary rank, as well as on a wide class of locally symmetric spaces, obtaining the euclidean analogue for the size of the parameter β.

References

[1] Effie Papageorgiou. *Oscillating multipliers on rank one locally symmetric spaces*, English, *Journal of Mathematical Analysis and Applications* **494**, no. 1 (2021). Id/No 124561, p. 13.

[2] Effie Papageorgiou. *Oscillating multipliers on symmetric spaces and locally symmetric spaces* (Nov. 2018). arXiv: `1811.03313 [math.RT]`.

On the conjectured extension of a classical theorem of Hilbert

— 13:00 UTC —
C.-R. Onti
University of Cyprus

In 1901 Hilbert proved that *there is no isometric immersion from the complete hyperbolic plane* $\mathbb{H}^2$ *into three-dimensional Euclidean*

space $\mathbb{R}^3$. It is a long-standing problem if the complete hyperbolic space $\mathbb{H}^n$ can be isometrically immersed in the Euclidean space $\mathbb{R}^{2n-1}$, when $n \geq 3$. In fact, the non-existence of such an immersion has been frequently conjectured by several mathematicians, among them Yau (1982), Moore (2002) and Gromov (2017).

The aim of our talk is to show that: *if such an immersion exists then the second fundamental form of that immersion has exponential growth.*

This is a recent work [1] in collaboration with Marcos Dajczer (IMPA) and Theodoros Vlachos (University of Ioannina).

References

[1] Marcos Dajczer, Christos-Raent Onti, and Theodoros Vlachos. *Isometric immersions with flat normal bundle between space forms*, *Archiv der Mathematik* (2021).

Thursday, April 22

The Willmore Flow with Prescribed Volume

— 11:00 UTC —
F. Rupp
Ulm University

For an immersed surface in $\mathbb{R}^3$, we study the L^2-gradient flow of the Willmore energy subject to a volume constraint. Despite its nonlocal nature, we show that the flow can be controlled in terms of the concentration of energy. This is used to prove a lower bound on the existence time, which enables us to construct a blow-up as it was done by Kuwert and Schätzle for the Willmore flow. With the help of a constrained Łojasiewicz–Simon inequality and a classification result for the concentration limit we show convergence to a round sphere if the initial energy is below 8π.

References

[1] Fabian Rupp. *On the Łojasiewicz-Simon gradient inequality on submanifolds*, English, *Journal of Functional Analysis* **279**, no. 8 (2020). Id/No 108708, p. 32.

[2] Fabian Rupp. *The volume-preserving Willmore flow* (Dec. 2020). arXiv: `2012.03553 [math.AP]`.

Minimal surface generating flow for space curves of non-vanishing torsion

— 12:00 UTC —

J. Minarčík
Czech Technical University in Pargue

This contribution introduces geometric flow of space curves during which the curve traces out a zero mean curvature surface. Existence problems and properties of the flow as well as the generated minimal surface will be discussed. Namely the Maximum principle, preserved quantities, analytical solutions and an a priori bound for the terminal time and the generated surface area.

References

[1] J. Minarčík and M. Beneš. *Minimal surface generating flow for space curves of non-vanishing torsion* (2020). submitted.

A Brakke type regularity for the parabolic Allen-Cahn equation

— 13:00 UTC —
S. Wang
Queen Mary University of London

We will talk about an analogue of the Brakke's local regularity theorem for the ϵ-parabolic Allen-Cahn equation. In particular, we show uniform $C^{2,\alpha}$ regularity for the transition layers converging to smooth mean curvature flows as ϵ tend to 0 under the almost unit-density assumption. This can be viewed as a diffused version of the Brakke regularity for the limit mean curvature flow. This talk is based on joint work with Huy Nguyen.

References

[1] Huy The Nguyen and Shengwen Wang. *Brakke Regularity for the Allen-Cahn Flow* (Oct. 2020). arXiv: 2010.12378 [math.AP].

[2] Huy The Nguyen and Shengwen Wang. *Second order estimates for transition layers and a curvature estimate for the parabolic Allen-Cahn* (Mar. 2020). arXiv: 2003.11886 [math.DG].

Mass Drop and Multiplicity in Mean Curvature Flow

— 17:45 UTC —

A. Payne
Courant Institute

Mean curvature flow may be continued through singularities via Brakke flow or level set flow. A Brakke flow may have discontinuous mass over time, i.e. have mass drop, which makes it like a subsolution to mean curvature flow. On the other hand, the level set flow may attain positive measure, which makes it like a supersolutions to the flow. In this talk, we will discuss the discrepancy between these two flows and relate this to various foundational open problems in mean curvature flow. In particular, we show that a weak form of the multiplicity one conjecture is equivalent to no mass drop for Brakke flows under natural assumptions. This extends Metzger-Schulze's no mass drop result for mean convex flows to some important non-mean convex cases.

References

[1] Alec Payne. *Mass Drop and Multiplicity in Mean Curvature Flow* (Sept. 2020). arXiv: `2009.14163 [math.DG]`.

Friday, April 23

Rigidity of compact Fuchsian manifolds with convex boundary

— 11:00 UTC —

R. Prosanov
University of Vienna

It is well-known that smooth convex bodies in 3-dimensional Euclidean space are rigid with respect to the induced boundary metric. The same result holds for smooth convex bodies in hyperbolic 3-space. It is also known (as Mostow's rigidity) that the metric of closed hyperbolic manifolds in dimensions bigger than 2 is determined by topology. As a common generalization it was shown by Schlenker that the metric of compact hyperbolic 3-manifolds with strictly convex boundary is determined by topology and by the induced metric on the boundary.

What happens if the boundary is not smooth? It was shown by Pogorelov (and later another proof was given by Volkov) that convex bodies in $\mathbb{E}^3$ are determined by the induced boundary metric even without smoothness assumption. We prove similar results for a family of hyperbolic 3-manifolds.

A compact Fuchsian manifold with boundary is a hyperbolic 3-manifold homeomorphic to $S_g \times [0;1]$ such that the boundary component $S_g \times \{0\}$ is geodesic. Here S_g is a closed

oriented surface of genus $g > 1$. Fuchsian manifolds are known as toy cases in the study of geometry of hyperbolic 3-manifolds with boundary. I am going to sketch a proof that a compact Fuchsian manifold with convex boundary is uniquely determined by the induced path metric on $S_g \times \{1\}$ without further restrictions on the boundary except convexity.

The talk is based on https://arxiv.org/abs/2007.14334

Poisson non-degeneracy of the Lie algebra $\mathfrak{so}(3,1)$

— 12:00 UTC —
F. Zeiser
Radboud University Nijmegen

In this talk we take a look at the linearization question in Poisson geometry as first asked by Weinstein. We briefly recall what is currently known for semisimple Lie algebras. Moreover, we outline a proof for the Poisson non-degeneracy of the Lie algebra $\mathfrak{so}(3,1) \cong \mathfrak{sl}_2(\mathbb{C})$. To do so we first calculate the Poisson cohomology of its associated linear Poisson structure by generalizing methods used for the case of $\mathfrak{sl}_2(\mathbb{R})$. Using the cochain homotopies obtained from this calculation we apply a Nash-Moser argument in a flat setting to obtain the linearization result. Hence $\mathfrak{so}(3,1)$ is the first example of a non-compact semisimple Lie algebra which is Poisson non-degenerate. This is based on joint work with Mărcuț:

References

[1] Ioan Mărcuț and Florian Zeiser. *The Poisson cohomology of* $\mathfrak{sl}_2^*(\mathbb{R})$ (Nov. 2019). arXiv: 1911.11732 [math.SG].

[2] Ioan Mărcuț and Florian Zeiser. *The Poisson linearization problem for the real Lie algebra* $\mathfrak{sl}_2(\mathbb{C})$. in prepraration.

Recent results in the study of geodesic orbit Riemannian manifolds

— 13:00 UTC —
N. P. Souris
University of Patras

Geodesic orbit manifolds (or g.o. manifolds) are Riemannian manifolds defined by the property that all geodesics are integral curves of Killing vector fields, or equivalently, orbits of one-parameter groups of isometries. Any g.o. manifold is homogeneous i.e. admits a transitive Lie group action. Although many subclasses of g.o. manifolds have been well-studied, such as Riemannian symmetric and weakly symmetric spaces, their complete classification is a longstanding open problem. In this talk, we discuss some key aspects of the classification problem as well as recent results on the subject.

References

[1] Nikolaos Panagiotis Souris. *Geodesic orbit metrics in compact homogeneous manifolds with equivalent isotropy submodules*, English, *Transformation Groups* **23**, no. 4 (2018), pp. 1149–1165.

[2] Nikolaos Panagiotis Souris. *On a class of geodesic orbit spaces with abelian isotropy subgroup*, *manuscripta mathematica* (2020).

Higher Order Generalizations of Harmonic Maps

— 14:00 UTC —

V. Branding
University of Vienna

Harmonic maps are one of the most famous geometric variational problems for maps between Riemannian manifolds. The harmonic map equation is a second order semilinear elliptic PDE and many results on questions of existence and qualitative behavior of solutions have been obtained in the literature.

Recently, many researchers got attracted in higher order variants of harmonic maps. First, we will introduce the notion of k-harmonic maps which are characterized by a semilinear elliptic PDE of order $2k$. We will discuss various recent results on these maps including unique continuation properties and the question under which conditions k-harmonic maps must be harmonic.

Finally, we will focus on a second higher order version of harmonic maps initially proposed by Eells and Sampson in 1964 and present several recent results on the latter. This is joint work with Stefano Montaldo, Cezar Oniciuc and Andrea Ratto.

The talk is based on the publications [1, 2] and the recent preprints [3, 4].

References

[1] V. Branding et al. *Higher order energy functionals*, English, *Advances in Mathematics* **370** (2020). Id/No 107236, p. 59.

[2] Volker Branding. *A structure theorem for polyharmonic maps between Riemannian manifolds*, English, *Journal of Differential Equations* **273** (2021), pp. 14–39.

[3] Volker Branding. *On finite energy solutions of 4-harmonic and ES-4-harmonic maps* (Sept. 2020). arXiv: 2009.07068 [math.DG].

[4] Volker Branding et al. *Unique continuation properties for polyharmonic maps between Riemannian manifolds* (Jan. 2021). arXiv: 2101.01066 [math.DG].

A List of Participants

Nat Sothanaphan
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University of Tehran
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