Velichkov   **CV**

Subsolutions of the Dirichlet energy functional. Density estimates and applications.
Università di Pavia, 08/05/2012.

Concentration-compactness principle and shape optimization problems.
Calcolo delle Variazioni ed Analisi Geometrica, Università di Pisa, 25/05/2011.

RESEARCH PERIODS AND INVITATIONS

- 10/03/2019 - 17/03/2019. SISSA Trieste. Invited by Guido De Philippis.

- 21/10/2018 - 02/11/2018. SISSA Trieste. Invited by Guido De Philippis.

- 27-31/03/2018. SISSA Trieste. Invited by Guido De Philippis.

- 05-17/03/2018. ETH Zürich. Invited by Maria Colombo.

- 20/02/2018-03/03/2018. Politecnico di Milano. Invited by Ilaria Fragalà.

- 05-11/02/2018. Università di Pisa. Invited by Giuseppe Butazzo.

- 20-24/03/2017. Politecnico di Milano. Invited by Ilaria Fragalà.

- 08-31/01/2017. Università di Pisa. Invited by Giuseppe Butazzo.

- 06-10/06/2016. SISSA Trieste. Invited by Giovanni Franzina.

- 09-13/05/2016. Max Planck Institut Leipzig. Invited by Luca Spolaor.

- 18-22/03/2016. Politecnico di Milano. Invited by Ilaria Fragalà.

- 11-15/04/2016. Universität Zürich. Invited by Annalisa Massaccesi.

- 04-08/04/2016. Università degli Studi di Torino. Invited by Susanna Terracini.

- 03-31/01/2016. Università di Pisa. Invited by Giuseppe Buttazzo.

- 13-17/07/2015. Università degli Studi di Torino. Invited by Susanna Terracini.

- 02-06/03/2015. Università di Pisa. Invited by Giuseppe Buttazzo.

- 26-30/10/2014. Università degli Studi di Torino. Invited by Susanna Terracini.

- 09-18/04/2014. Isaac Newton Institute, Cambridge. Visit during the research period *Free boundary problems and related topics*.

- 19-21/03/2014. Université Paris Dauphine. Invited by Jimmy Lamboley.

- 07-11/04/2013. Friedrich Alexander Universität Erlangen - Nürnberg. Invited by Aldo Pratelli.

- 06-08/05/2012. Università di Pavia. Invited by Aldo Pratelli.

LIST OF PUBLICATIONS

Preprints

[P3] M. Colombo, L. Spolaor, B. Velichkov : *Almost everywhere uniqueness of blow-up limits for the lower dimensional obstacle problem.*
Preprint CVGMT http://cvgmt.sns.it/paper/4435/

[P2] B. Velichkov : *Regularity of the one-phase free boundaries.* Lecture notes.
Preprint CVGMT http://cvgmt.sns.it/paper/4367/

[P1] M. Engelstein, L. Spolaor, B. Velichkov : *Uniqueness of the blow-up at isolated singularities for the Alt-Caffarelli functional.* Preprint arXiv:1801.09276

Journal articles

[A31] E. Russ, B. Trey, B. Velichkov : *Existence and regularity of optimal shapes for elliptic operators with drift.* Accepted: **Calc. Var. PDE** (Preprint arXiv:1810.07943)

[A30] M. Colombo, L. Spolaor, B. Velichkov : *On the asymptotic behavior of the solutions to parabolic variational inequalities.* Accepted: **Crelle** (Preprint arXiv:1809.06075)

[A29] L. Spolaor, B. Trey, B. Velichkov : *Free boundary regularity for a multiphase shape optimization problem.* Accepted: **Comm. PDE** (Preprint arXiv:1810.06963)

[A28] D. Mazzoleni, S. Terracini, B. Velichkov : *Regularity of the free boundary for the vectorial Bernoulli problem.* Accepted: **Anal. PDE** (Preprint arXiv:1804.09243)

[A27] M. Colombo, L. Spolaor, B. Velichkov : *Direct epiperimetric inequalities for the thin obstacle problem and applications.* Accepted: **Comm. Pure. Appl. Math.** (Preprint arXiv:1709.03120)

[A26] M. Engelstein, L. Spolaor, B. Velichkov : *(Log-)epiperimetric inequality and regularity over smooth cones for almost area-minimizing currents.* **Geometry & Topology** (2018).
https://msp.org/scripts/coming.php?jpath=gt

[A25] I. Fragalà, B. Velichkov : *Serrin-type theorems for triangles.* **Proc. Amer. Math. Soc.** (2018).
https://doi.org/10.1090/proc/14352

[A24] G. Buttazzo, F. Maestre, B. Velichkov : *Optimal potentials for problems with changing sing data.* **J. Optim. Theory Appl.** 178 (3) (2018), 742–762.

[A23] M. Colombo, L. Spolaor, B. Velichkov : *A logarithmic epiperimetric inequality for the obstacle problem.* **Geom. Funct. Anal.** 28 (4) (2018), 1029–1061.

[A22] G. Buttazzo, B. Velichkov : *A shape optimal control problem with changing sign data.* **SIAM J. Math. Anal.** 50 (3) (2018), 2608–2627.

[A21] L. Spolaor, B. Velichkov : *An epiperimetric inequality for the regularity of some free boundary problems: the 2-dimensional case.* **Comm. Pure. Appl. Math.** 72 (2) (2018), 375–421.

[A20] G. De Philippis, J. Lamboley, M. Pierre, B. Velichkov : *Regularity of minimizers of shape optimization problems involving perimeter.* **J. Math. Pure. Appl.** 109 (2018), 147–181.

[A19] D. Bucur, I. Fragalà, B. Velichkov, G. Verzini : *On the honeycomb conjecture for a class of minimal convex partitions.* **Trans. Amer. Math. Soc.** 370 (10) (2018), 7149–7179.

[A18] D. Mazzoleni, S. Terracini, B. Velichkov : *Regularity of the optimal sets for some spectral functionals.* **Geom. Funct. Anal.** 27 (2017), 373–426.

[A17] A. Massaccesi, E. Oudet, B. Velichkov : *Numerical Calibration of Steiner trees.* **Appl. Math. Optim.** (2017). https://doi.org/10.1007/s00245-017-9421-5

[A16] J.C. Bellido, G. Buttazzo, B. Velichkov : *Worst-case shape optimization for the Dirichlet energy.* **Nonlinear Analysis** 153 (2017), 117–129.

[A15] G. De Philippis, A. Meszaros, F. Santambrogio, B. Velichkov : *BV Estimates in Optimal Transportation and Applications.* **Arch. Rat. Mech. Anal.** 219 (2) (2016), 829–860.

[A14] D. Bucur, D. Mazzoleni, A. Pratelli, B. Velichkov : *Lipschitz Regularity of the Eigenfunctions on Optimal Domains.* **Arch. Rat. Mech. Anal.** 216 (2015), 117–151.

[A13] L. Brasco, G. De Philippis, B. Velichkov : *Faber-Krahn inequalities in sharp quantitative form.*
Duke Math. J. 164 (9) (2015), 1777–1831.

[A12] G. Buttazzo, E. Oudet, B. Velichkov : *A free boundary problem arising in PDE optimization.*
Calc. Var. PDE 54 (4) (2015), 3829–3856.

[A11] B. Bogosel, B. Velichkov : *Multiphase Optimization Problems for Eigenvalues: Qualitative Properties and Numerical Results.* **SIAM J. Numer. Anal.** 54 (1) (2015), 210–241.

[A10] D. Bucur, B. Velichkov : *A free boundary approach to shape optimisation problems.*
Phil. Trans. R. Soc. A 373 (2015).

[A9] G. De Philippis, B. Velichkov : *Existence and regularity of minimizers for some spectral optimization problems with perimeter constraint.* **Appl. Math. Optim.** 69 (2) (2014), 199–231.

[A8] G. Buttazzo, B. Ruffini, B. Velichkov : *Spectral optimization problems for metric graphs.*
ESAIM: COCV 20 (1) (2014) 1–22.

[A7] B. Velichkov : *A Note on the Monotonicity Formula of Caffarelli-Jerison-Kenig.*
Rend. Lincei Mat. Appl. 25 (2014), 165–189.

[A6] G. Buttazzo, A. Gerolin, B. Ruffini, B. Velichkov : *Optimal potentials for Schrödinger operators.*
Journal de l'École Polytechnique 1 (2014), 71–100.

[A5] D. Bucur, G. Buttazzo, B. Velichkov : *Spectral Optimization Problems for Potentials and Measures.* **SIAM J. Math. Anal.** 46 (4) (2014), 2956–2986.

[A4] D. Bucur, B. Velichkov : *Multiphase shape optimization problems.*
SIAM J. Control Optim. 52 (6) (2014), 3556–3591.

[A3] G. Buttazzo, B. Velichkov : *Some new problems in spectral optimization.*
Banach Center Publications 101 (2014), 19–35.

[A2] D. Bucur, G. Buttazzo, B. Velichkov : *Spectral optimization problems with internal constraint.*
Ann. I. H. Poincaré 30 (3) (2013), 477–495.

[A1] G. Buttazzo, B. Velichkov : *Shape optimization problems on metric measure spaces.*
J. Funct. Anal. 264 (1) (2013), 1–33.

Book chapters

[B4] G. Buttazzo, B. Velichkov : *Spectral optimization problems for Schrödinger operators.* Shape Optimization and Spectral Theory, De Gruyter (2017), 325–352.

[B3] G. Buttazzo, B. Velichkov : *The spectral drop problem.* Contemporary Mathematics **666** (2016), 111–135.

[B2] G. Buttazzo, M. Van Den Berg, B. Velichkov : *Optimization problems involving the first Dirichlet eigenvalue and the torsional rigidity.* New Trends in Shape Optimization, Springer (2015), 19–41.

[B1] V. Georgiev, B. Velichkov : *Decay estimates for the supercritical 3-D Schrödinger equation with rapidly decreasing potential.* Progr. in Math. **301** (2012), 145–162.

Monographs

[M1] B. Velichkov : *Existence and regularity results for some shape optimization problems.*
Edizioni della Normale, Tesi 19, Springer 2015, ISBN 978-88-7642-526-4.

FUNDING ID

Project Title	Funding source	Amount	Period (mm/yyyy)	My role
Variational approach to the regularity of the free boundaries - **VAREG**	ERC	1.333kE	TBA	P.I.
Shape Optimization - **ShapO**	ANR	300kE	10/2018 - 10/2022	local coordinator
Convergent Metrics for Digital Calculus - **CoMeDiC**	ANR	400kE	10/2015 - 09/2020	member
Geometry and Spectral Optimization - **GeoSpec**	ANR	250kE	09/2016 - 02/2020	member
Méthodes Variationnelles en Optimisation de Formes - **VariForm**	UGA	15kE	4/2015 - 12/2016	P.I.

ANR = Agence Nationale de la Recherche   UGA = Université Grenoble Alpes
ERC = European Research Council

I am the **Principal Inverstigator** of the *ERC Starting Grant* project

VAREG - "Variational approach to the regularity of the free boundaries"

financed by the program Horizon 2020.

Duration: 60 months, TBA. **Volume**: 1,333kE.

Summary: This project is dedicated to the study of the regularity of the free boundaries via variational techniques as the epiperimetric and the logarithmic epiperimetric inequality.

I was the **Principal Inverstigator** of the project

VariForm - "Méthodes Variationnelles en Optimisation de Formes"

financed by the program "Alpes Grenoble Innovation Recherche" of Université Grenoble Alpes.

Duration: 2 years, 2015-2016. **Volume**: 15kE.

Summary: This project was dedicated to the study of monotonicity formulas and their applications to the regularity of the free boundaries arising in variational free boundary and shape optimization problems. My main contributions, developed in the context of this project are the following:

[MTV] D. Mazzoleni, S. Terracini, B. Velichkov. *Regularity of the optimal sets for some spectral functionals.* **Geom. Funct. Anal.** 27 (2017), 373–426.

[SV] L. Spolaor, B. Velichkov. *An epiperimetric inequality for the regularity of some free boundary problems: the 2-dimensional case.* **Comm. Pure. Appl. Math.** (2018).
https://doi.org/10.1002/cpa.21785

The papers [MTV] and [SV] were fundamental for my subsequent research on the regularity of the free boundaries. The methods pioneered in [SV] later led to the introduction of the *logarithmic epiperimetric inequality*.

I am local coordinator of the national project

ANR ShapO - "Shape Optimization"

financed by ANR - Agence Nationale de Recherche.

Coordinator: Jimmy Lamboley.
Local coordinators: Ilaria Lucardesi, Berardo Ruffini, Bozhidar Velichkov.
Volume: 300kE. **Duration**: 4 years (2018-2022).

Summary: This project has 22 members (and 10 non-permanent members: PhD students and post-docs). It covers a large spectrum of shape optimization problems and gathers a big part of the shape optimization community in France.

Administrative organization: The projects involves 4 partners. I am local coordinator of "Partner 2 - Grenoble" with 5 permanent members (Edouard Oudet, Emmanuel Russ, Charles Dapogny, Dorin Bucur) and 4 PhD students.

Scientific organization (research groups): The members of the project are organized in the following research groups (teams), working on different parts (tasks) of the project:
1.1. *Principal eigenvalue for non-symmetric/non-local elliptic operators.*
1.2. *Charged liquid drops.*   **1.3.** *Uncertainties.*
2.1. *Topological constraints.*   **2.2.** *Global geometrical constraints.*
2.3. *Partitions and optimization among polygons.*   **2.4.** *Engineering constraints.*
3.1. *Shape flow with respect to the first eigenvalue of the Dirichlet Laplacian.*
3.2. *Shape flows for general cost functionals.* **3.3.** *Evolution problems for potentials and measures.*
4.1. *Numerical investigations around geometric constraints.*
4.2. *Modeling and numerical implementation for problems issued from mechanical engineering, physics and life sciences.*
I am scientific coordinator of the research group **3.1** and member of **1.3**, **2.1**, **2.3** and **3.3**.
I am also organized the first meeting of the project, which will be in Grenoble, 6-7/12/2018.

I am scientific coordinator of the **research group**

"Shape flow with respect to the first eigenvalue of the Dirichlet Laplacian"

of the national project ANR ShapO "Shape Optimization".

Permanent members:
- Bozhidar Velichkov (Maître de Conférences, Université Grenoble Alpes, coordinator);
- Virginie Bonnaillie-Noël (Directeur de Recherche, CNRS);
- Dorin Bucur (Full Professor, Université de Savoie);
- Gisella Croce (Maître de Conférences, Université du Havre);
- Marc Dambrine (Full Professor, Université de Pau);
- Jimmy Lamboley (Full Professor, Université Pierre et Marie Curie).

Summary of the objectives: Shape evolution problems have a big impact on applied sciences, and they also have important applications to questions with purely theoretical taste as for example, the regularity of free boundary problems. Of particular interest is the shape flow on the sphere defined with respect to the functional $\mathcal{F}(\Omega) := \lambda_1(\Omega) + Vol(\Omega)$, where $\lambda_1(\Omega)$ is the first eigenfunction of the spherical domain Ω. The construction of such a flow is one of the main objectives of ShapO.

My role in the research group:
- I participate as a scientific coordinator and an expert in the regularity of the free boundaries.
- I defined the main objectives of the research group and wrote the related part of the project proposal.

I am member of the **research group**

"Uncertainties"

of the project ANR ShapO "Shape Optimization".

Permanent members:

- Marc Dambrine (Full Professor, Université de Pau, coordinator);
- Grégoire Allaire (Full Professor, École Polytechnique);
- Charles Dapogny (Researcher CNRS);
- Bozhidar Velichkov (Maître de Conférences, Université Grenoble Alpes).

Summary of the objectives: We aim to model new types of uncertainties arising in shape optimization, for instance, those incurred by the manufacturing processes of mechanical or physical devices. We aim to develop stochastic calculus for randomly perturbed shapes: given a probability space of random perturbations acting on a given shape, we want to study tools to compute the mean and the variance of a given shape functional. The existence of optimal domains with respect to this type of stochastic shape functionals is a challenging open question: the functionals obtained through this kind of procedure are typically not monotone and the usual existence theorems cannot be applied, so we aim to develop new techniques to cover this case.

My role in the research group:

- I participate as an expert in the theoretical aspects of shape optimization problems involving uncertainties.

I am member of the **research group**

"Topological constraints"

of the national project ANR ShapO "Shape Optimization".

Permanent members:

- Antoine Lemenant (Maître de Conférences, Université Paris Sud, coordinator);
- Dorin Bucur (Full Professor, Université de Savoie);
- Antoine Henrot (Full Professor, École des Mines de Nancy);
- Jimmy Lamboley (Full Professor, Université Pierre et Marie Curie),
- Bozhidar Velichkov (Maître de Conférences, Université Grenoble Alpes).

Summary of the objectives: The aim of this research group is to study shape optimization problems under topological constraints. There are two main research directions:

(1) *Shape optimization problems for simply connected open sets.* This topological constraint is stable for deformation by vector fields so, at least formally, the optimality conditions lead to overdetermined free boundary problem. However, many of the known regularity techniques are hard to apply, since the constraint is of non-local nature. This is related, for instance, to the isoperimetric conjecture on the buckling load of the clamped plate (Polya and Szego, 1954).

(2) *Shape optimization problems involving closed connected sets of dimension one.* A large class of free discontinuity problems involves one dimensional connected sets, the objective being to minimize an energy associating a physical energy and the length. An important example is the compliance problem from mechanics, where one considers a membrane subject to some deformation, which is attached to a certain unknown connected one-dimensional Dirichlet region Σ. One of our main objectives is to study the regularity of the optimal sets Σ arising in this context.

My role in this research group:

- I participate as an expert in the regularity of the free boundaries and the optimal shapes.

I am **member** of the **research group**

"Partitions and optimization among polygons"

of the national project ANR ShapO "Shape Optimization".

Permanent members:

- Dorin Bucur (Full Professor, Université de Savoie, coordinator);
- Virginie Bonnaillie-Noel (Directeur de Recherche, CNRS);
- Jimmy Lamboley (Full Professor, Université Pierre et Marie Curie);
- Enea Parini (Maître de Conférences, Université Aix-Marseille);
- Yannick Privat (Full Professor, Université de Strasbourg);
- Bozhidar Velichkov (Maître de Conférences, Université Grenoble Alpes);
- Alessandro Zilio (Maître de Conférences, Université Paris Diderot).

Summary: In 2005-2007, Burdzy, Caffarelli-Lin and Van den Berg conjectured in different contexts that the asymptotic behavior of optimal partitions of a plane domain in cells minimizing the sum of their fundamental Dirichlet Laplacian eigenvalues is given by a honeycomb structure. The interest for this question arises in the study of segregated configurations of competition-diffusion systems, energy minimizing configurations of Bose-Einstein condensates and the structure of the nodal domains of higher order eigenvalues. Recent results, in which members of the group have been involved (Bucur and Velichkov), opened new avenues and reduced the conjecture to understanding the discrete Faber-Krahn inequality on polygons with 5, 6 and 7 edges.

My role in the research group:

- I participate as an expert in the regularity of the optimal shapes for multiphase and optimal partition problems. I will also contribute with my experience in the study of the asymptotic behavior of the optimal partitions.

I am **member** of the **research group**

"Evolution problems for potentials and measures"

of the national project ANR ShapO "Shape Optimization".

Permanent members:

- Berardo Ruffini (Maître de Conférences, Université de Montpelier, coordinator);
- Dorin Bucur (Full Professor, Université de Savoie);
- Michael Goldman (Researcher CNRS);
- Ilaria Lucardesi (Maître de Conférences, École des Mines de Nancy);
- Bozhidar Velichkov (Maître de Conférences, Université Grenoble Alpes);
- Alessandro Zilio (Maître de Conférences, Université Paris Diderot).

Summary: We consider variational evolution with respect to cost functionals depending on the solutions of a PDE ruled by SchrÃ¶dinger potentials $-\Delta + V$ on $\mathbb{R}^d$. In this context, regularity issues are much easier to handle, and since the optimal potentials may approximate the optimal sets, this provides a tool for the numerical approximation of shape flows. As a first test, we will study the functional $V \mapsto \lambda_1(-\Delta + V) + \int F(V(x))\, dx$. The main objectives are:

- Prove the existence of the flow starting from a non-negative measurable potential.
- Prove that there is a sequence of weight functions F_n, for which the respective flows of potentials converge to a shape flow.

My role in this research group:

- I participate as an expert in spectral optimization problems involving potential and measures.
- I participated in the definition of the main objectives of this research group and I wrote the related part of the project proposal ShapO.

I am member of the **research group**

> *"Spectral theory: Vector fields, complexity and diffusion"*

of the project **GeoSpec** "Geometry and Spectral Optimization".

Duration of the project: 42 months (2016-2020), ~ 250kE.

Coordinators: Gérard Besson, Édouard Oudet.

Web page: https://ljk.imag.fr/GeoSpec/

Members of the research group:

- Gérard Besson (Directeur de Recherche CNRS);
- Dorin Bucur (Full Professor, Université de Savoie);
- Emmanuel Russ (Full Professor, Université Grenoble Alpes);
- Bozhidar Velichkov (Maître de Conférences, Université Grenoble Alpes);
- my PhD students Baptiste Trey and François Generau.

Summary of the objectives of GeoSpec: The general goal of this project is to combine the knowledge of theoretical and applied mathematicians in order to study optimal manifolds with respect to complex criteria, under complex geometrical constraints. This project aims to develop new approaches in the numerical approximation of optimal or critical manifolds and the analysis of shape optimization problems under complex geometrical constraints. The focus is on problematics in which both theoretical and applied mathematicians are involved. By this proposal, our team targets progress on understanding deeper the following three different fields of metric structures, dynamical systems and spectral theory.

Summary of the objectives of the research groups: We investigate different variational shape optimization and free boundary methods that can be used to approach problems in applied geometry, as for instance, the numerical computation of the cut-locus of a distance function and the closed geodesics of minimal length on a given compact surface.

My role in the project and the research group:

- I participate in GeoSpec as an expert in the regularity for shape optimization problems.
- I participated in defining the objectives of the research group and in writing the project proposal.
- I am advisor of the PhD student Baptiste Trey, whose thesis is financed by GeoSpec.
- I organized the following workshops on thematics related to the project:

> Calculus of Variations and Free Boundary Problems I - Grenoble, 2017.
> http://www.velichkov.it/workshop_geospec.html

> Calculus of Variations and Free Boundary Problems II - Grenoble, 2018.
> http://www.velichkov.it/workshop_cvfbp_2.html

- In march 2017, I gave a talk, on the project's seminar/working group, with the following title:

> *Régularité de la frontière libre pour le problème de Bernoulli: une approche variationnelle.*

- My main contributions to the project are the following:

> [RTV] E. Russ, B. Trey, B. Velichkov. *Existence and regularity of optimal shapes for elliptic operators with drift.* Preprint arXiv:1810.07943

> [STV] L. Spolaor, B. Trey, B. Velichkov. *Free boundary regularity for a multiphase shape optimization problem.* Preprint arXiv:1810.06963

I am **member** of the national project

<div align="center">ANR CoMeDiC "Convergent Metrics for Digital Calculus"</div>

Duration: 5 years (2015-2020). **Volume**: ~400kE.

Coordinator: Jacques-Olivier Lachaud.

Web page: https://lama.univ-savoie.fr/comedic/

Summary: The project involves 4 teams and 23 members, most of them specialists in Numerical Analysis and Informatics; it aims to develop discrete calculus methods in digitalized spaces. I am part of the team at Laboratoire Jean Kuntzmann (members: me, Edouard Oudet and Boris Thibert) and I am involved in the following work groups:

- Research group on *Subtask 1.2. Adaptation of variational problems to digital calculus*
    - *Coordinator:* Édouard Oudet;
    - *Members:* Dorin Bucur, David Coeurjolly, Jacques-Olivier Lachaud, Laurent Najman, Edouard Oudet, Tristan Roussillon, Hugues Talbot, Bozhidar Velichkov;
    - *Short description of the objectives:* Introduce efficient and relevant discretization of differential operators on singular objects. Express problems involving functionals with discontinuities (like Mumford-Shah and Ambrosio-Tortorelli) or free boundaries in digital calculus. Combine Γ-convergence theory with geometric measure tools to get stronger formulation of convergence for digital calculus. Incorporate known geometric Γ-convergence results into digital calculus.

- Research group on *Subtask 2.3. Digital calculus for shape optimization*
    - *Coordinator:* Édouard Oudet;
    - *Members:* Dorin Bucur, Jacques-Olivier Lachaud, Laurent Najman, Edouard Oudet, Pascal Romon, Hugues Talbot, Boris Thibert, Bozhidar Velichkov;
    - *Short description of the objectives:* Consider digital calculus to approximate optimal geometrical structure of shape optimization problems. Impact on the identification of calibrations to characterize global optimal structures (minimal surfaces, Steiner tree problem,...).

My role and contributions to CoMeDiC:

- Together with Boris Thibert, I organized the project workshop-meeting

    MEETING T24 - LJK (Laboratoire Jean Kuntzmann, Grenoble, 15-16 January 2018).

- In 2017, I gave a talk entitled

    <div align="center">*Honeycomb conjectures on convex sets.*</div>

on the project meeting-workshop

<div align="center">MEETING T18 - LAMA (Autrans, 12-16 June 2017).</div>

- My main scientific contributions related to the projects are:

> [BFVV] D. Bucur, I. Fragalà, B. Velichkov, G. Verzini.
> *On the honeycomb conjecture for a class of minimal convex partitions.*
> Trans. Amer. Math. Soc. **370** (10) (2018), 7149–7179.

> [MOV] A. Massaccesi, E. Oudet, B. Velichkov.
> *Numerical Calibration of Steiner trees.* Appl. Math. Optim. (2017).
> https://doi.org/10.1007/s00245-017-9421-5

In the period 2011-2014, as a PhD student, I was an active participant in the research groups of the following (french) national projects:

- ANR Optiform - *Shape optimization.*
  Period: 2012-2016. **Coordinator:** *Antoine Henrot.*
  Web page: `https://optiform.ec-lyon.fr/index.php`

- ANR GAOS - *Geometric analysis of optimal shapes.*
  Period: 2009-2012. **Coordinator:** *Dorin Bucur.*
  Web page: `https://www.lama.univ-savoie.fr/pagesmembres/bucur/WWW-ANR/index.php`

Since 2011, I participated to all the meetings of these projects and I gave the following talks:

- *Shape optimization problems with Neumann boundary conditions.*
  Project meeting ANR Optiform (Nancy, 25/02/2014).

- *Multiphase shape optimization problems.*
  Project meeting ANR Optiform (Paris, 26/11/2013).

- *Existence and regularity for some spectral optimization problems with perimeter constraint.*
  Project meeting ANR Optiform (Rennes, 22/01/2013).

- *Shape optimization problems with internal constraint.*
  Project meeting ANR GAOS (Chambery, 02/06/2011).

Allegato n. 11
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Verbale del 4-11-2019

Dal curriculum di Bozhidar Velichkov emerge il profilo di un ricercatore di primissimo livello, che ha ottenuto risultati eccellenti e appare attivissimo, con progetti di ricerca di grande rilevanza in campi di indagine centrali della matematica moderna. All'eccellenza scientifica si accompagna inoltre una chiara propensione all'organizzazione, all'interazione con altri ricercatori, alla didattica specialistica e di base.

Uno dei principali argomenti di ricerca di Bozhidar Velichkov è lo studio della regolarità ottimale di soluzioni di equazioni differenziali e di minimi di problemi variazionali. Questo tema, centrale nella moderna Analisi matematica, è attualmente poco sviluppato nel nostro dipartimento e si configura quindi come complemento ideale dei temi di ricerca da noi trattati.

Per questi motivi il consiglio di dipartimento, constatato che il profilo scientifico e didattico di Bozhidar Velichkov è decisamente quello di un professore di prima fascia, ne propone con convinzione la chiamata su una posizione di professore ordinario nel settore MAT/05.

Allegato n. 12

Pag. n. 1

Verbale del 4-11-2019