Curriculum Vitae

Nguyen Tien Khai

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Education

- 2008-2011 **Ph.D in Mathematics**, University of Padova, Italy.

  PhD advisor: Prof. Giovanni Colombo
  Website: http://www.math.unipd.it/colombo

  Thesis: The regularity of the minimum time function via nonsmooth analysis and geometric measure theory.

- 2002-2006 **B.S., Honor program in Mathematics**
  University of Natural Sciences, Ho Chi Minh City, Vietnam.

Appointments

- 08.2013 – 06.2016 **S. Chowla Assistant Professor**, PSU Mathematics Department, USA.

  Mentor: Prof. Alberto Bressan
  Website: https://www.math.psu.edu/bressan

- 01.2011 – 07.2013 **Postdoctoral Fellow**, S.I.S.S.A, Italy.

  Mentor: Prof. Fabio Ancona
  Website: http://www.math.unipd.it/ancona

- 09.2006 – 12.2007 **Lecturer**, Department of Mathematics and Computer Science, University of Science, Vietnam National University, Ho Chi Minh, Vietnam.

Honors & Awards

- 2011–2013 Postdoctoral Fellowship from S.I.S.S.A (ERC grant), Italy.
- 2008–2010 Cariparo fellowship, University of Padova, Italy.
- 2007 Odon Vallet Scholarship, Vietnam.
- 2002–2006 Outstanding Student Scholarships, University of Science, Vietnam National University, Ho Chi Minh, Vietnam.
- 2003 Third prize of National Mathematical Olympiad for Students (Analysis), Vietnam.
- 2002 Third prize of Vietnam National Selection in Mathematics for high school students, Vietnam.
- 2002 First prize of Ho Chi Minh city Selection in Mathematics for high school students, Vietnam.

Research Interests

- Nonlinear Partial Differential Equations.
- Optimal Control Problems and Differential Games.
- Nonsmooth Analysis and Geometric Measure Theory.

Preprints

25. The Bang-Bang theorem via Baire category. A Dual Approach , (with Alberto Bressan, Marco Mazzola), submitted.
24. On the Burgers-Poisson equation, (with K. Grunert), submitted.
23. Generalized control systems in the space of probability measures, (with Giulia Cavagnari, Antonio Marigonda, Fabio S. Priuli), submitted.

Publications

Nonlinear Partial Differential Equations

22. The compactness estimates for Hamilton Jacobi Equations depending on space, (with Fabio Ancona and Piermarco Cannarsa), *Bulletin of the Institute of Mathematics, Academia Sinica* (2015), to appear.
21. Quantitative compactness for Hamilton Jacobi Equations, (with Fabio Ancona and Piermarco Cannarsa), *Arch. Rat. Mech. Anal.* (2015), DOI 10.1007/s00205-015-0907-5.
20. Optima and Equilibria for Traffic Flow on Networks with Backward Propagating Queues, (with Alberto Bressan), *Networks & Heter. Media* (2015), DOI 10.3934/nhm.2015.10.717.
19. Conservation Law Models for Traffic Flow on a Network of Roads, (with Alberto Bressan), *Networks & Heter. Media* **10** (2015), no. 2, 255–292.
18. On compactness estimates for general nonlinear system hyperbolic systems, (with Fabio Ancona and Oliver Glass), *Ann. Inst. H. Poincare Anal. Non Lineaire* (2014), DOI:10.1016/j.anihpc.2014.09.002.
17. Global Existence of Weak Solutions for the Burgers-Hilbert Equation, (with Alberto Bressan), *SIAM Journal on Mathematical Analysis* **46** (2014), no. 4, 2884–2904.
16. Singular gradient flow and homotopic equivalence, (with P. Albano, P. Cannarsa and C. Sinestrari), *Mathematische Annalen* **356** (2013), 23–43.
15. Lower compactness estimates for scalar balance laws, (with Fabio Ancona and Olivier Glass), *Comm. Pure Appl. Math* **65** (2012), no. 9, 1303–1329.

Optimal Control Problems and Differential Games

14. An Equilibrium Model of Debt and Bankruptcy, (with Alberto Bressan), ESAIM: Control, Optimisation and Calculus of Variations, accepted.
13. SBV regularity of minimum time function for a class of differential inclusions, (with Piermarco Cannarsa and Antonio Marigonda), *Journal of Mathematical Analysis and Applications* **427** (2015), no. 1, 202–228.
12. Non-Lipschitz points and the SBV regularity of the minimum time function (with Giovanni Colombo, Luong V. Nguyen), *Calc. Var. Partial Differential Equations* (2014), no. 1–2, 439–463.
11. The minimum time function around the origin, (with Giovanni Colombo), *Mathematical Control and Related Fields* **3** (2013), no. 1, 51–82.

10. Some regularity results for a class of upper semicontinuous functions, (with Antonio Marigonda and Davide Vittone), *Indiana University Mathematics Journal* (2013), no. 1, 45–89.

9. Rectifiability of special singularities of non-lipschitz functions, (with Davide Vittone), *Journal of Convex Analysis* **19** (2012), no. 1, 159–170.

8. External sphere condition and time optimal control for differential inclusions, (with Piermarco Cannarsa), *SIAM J. Control Optim* **49** (2011), no. 6, 2558–2576.

7. On the structure of the minimum time function, (with Giovanni Colombo), *SIAM J. Control Optim* **48** (2010), no. 7, 4776-4814.

6. Hypographs satisfying external sphere condition and the regularity of the minimum time function, *Journal of Mathematical Analysis and Applications* 372 (2010), 611–628.

5. Quantitative isoperimetric inequalities for a class of nonconvex sets, (with Giovanni Colombo), *Calc. Var. Partial Differential Equations* **37** (2010), no. 1-2, 141–166.

Proceedings

4. BV regularity and differentiability properties of a class of upper semicontinuous functions, (with Antonio Marigonda and Davide Vittone), *proceedings of the Ninth International Conference on "Large Scale Scientific Computations",* June 3-7, 2013, Sozopol, Bulgaria.

3. On quantitative compactness for hyperbolic system conservation laws, (with Fabio Ancona and Olivier Glass), *Hyperbolic problems: theory, numerics and applications. Proceedings of the 14th International Conference on Hyperbolic Problems (HYP2012), AIMS, Springfield*, MO, 2014.

Undergraduate publications

2. Critical points of non-C2 functional, (with Duong Minh Duc, Tran Vinh Hung), *Topol. Methods Nonlinear Anal.* **29** (2007), no. 1, 35–68.

1. Morse-Palais Lemma for nonsmooth functionals on normed spaces, (with Duong Minh Duc, Tran Vinh Hung), *Proc. Amer. Math. Soc.* **135** (2007), no. 3, 921–927.

Teaching

Regular teaching

- Fall 2015 — Math 141 Section 16, 17, *Calculus with Analytic Geometry II*, Penn State university.
- Spring 2014 — Math 251 Section 13, 14, *Ordinary and partial differential equations*, Penn State university.
- Fall 2014 — Math 251, *Ordinary and partial differential equations*, Penn State university.
- Fall 2013 — Math 251, *Ordinary and partial differential equations*, Penn State university.

REU

- Summer 2015 — Tutorial, introduction to control theory.

Invited courses

- 04-05.2013 — PhD course, *Topics on optimal control and PDEs* (22 hours), Department of Pure and Applied Mathematics, Padova University of Italy.

- 02.2013 Master course, *Topics on optimal control and PDEs* (45 hours), University of Natural Sciences, HCM, Vietnam.

Advising Students

- 2014–2015 Advisor of a honor undergraduate student in Vietnam
  Thesis: *Linear control systems and the regularity of the minimum time function.*
- Summer 2014 Co-advisor of three undergraduate students for REU project of Department of Mathematics, Penn State Univeristy
  Topic: *game-theoretical model of debt and bankruptcy.*

Short visits

- Visiting scholar at Department of Mathematics, Padova University, Italy, May 17 – July 18, 2014. Host: Prof. Giovanni Colombo and Fabio Ancona.
- Department of Mathematics, University of Rome "Tor Vergata", Italy, March 2013 (1 week). Host: Prof. Piermarco Cannarsa.
- Scuola Internazionale Superiore di Studi Avanzati (SISSA), Italy, May 2013 (2 weeks). Host: Prof. Bianchini Stefano.
- Nonlinear Hyperbolic PDEs, Dispersive and Transport Equations: Analysis and Control, SISSA, May 15 - June 30, 2011.
- Université Paris-Dauphine, France, 2011 (2 weeks). Host: Prof. Olivier Glass.
- Control of partial differential equations and applications, Institut Henri Poincaré, France, October 02 -24 and December 15 - 22 , 2010.
- Summer Course in Mathematics - Perugia, Italy, July 28 - August 28, 2008.

Invited talks

- 11.2015 Department of Mathematics, Tulane University
  Colloquium: *Conservation laws and some applications to traffic flows.*
- 05.2015 University of Natural Sciences, HCM, Vietnam
  Seminar: *Conservation laws and some applications to traffic flows.*
- 04.2015 PDE seminar, UTK, Knoxville,
  Seminar: *On quantitative compactness estimates for hyperbolic conservation laws and HJ equations.*
- 03.2015 Department of Mathematics, Indiana University Bloomington,
  Seminar: *On quantitative compactness estimates for hyperbolic conservation laws and HJ equations.*
- 02.2015 Department of Mathematics, Loyola University, USA.
  Seminar: *Conservation laws and some applications to traffic flows.*
- 02.2015 Department of Applied Mathematics, University of Waterloo, Canada,
  Seminar: *Conservation laws and some applications to traffic flows.*
- 09.2014 "Entropy and Singular Solutions for Conservation Laws: Pressureless Gas Dynamics and Other Applications", Department of Mathematics, West Virginia University Morgantown, WV, USA
  Invited Speaker: *On quantitative compactness estimates for hyperbolic conservation laws and HJ equations.*

- 08.2014 Mathematical Conference: "Summer Meeting 2014", August 10-11, 2014, HCM, Vietnam
  PLENARY SPEAKER: *Quantitative Compactness estimates for Hamilton-Jacobi equations.*
- 06.2014 Conference on New Trends in Optimal Control, June 23–27, 2014 - Tours, France
  INVITED SPEAKER: *A game-theoretical model of debt and bankruptcy.*
- 06.2014 Workshop "Analysis and Geometry in Control Theory and its Applications", June 9–13, 2014 - INDAM, Rome, Italy
  INVITED SPEAKER: *Quantitative Compactness estimates for Hamilton-Jacobi equations.*
- 06.2014 Differential Equations and Applications, Department of Mathematics, Padova University, Italy
  SEMINAR: *Global Existence of Weak Solutions for the Burgers-Hilbert Equation.*
- 06.2013 The Meeting on Differential Equations, Inverse Problems and Control Theory, Cortona, Italy
  INVITED SPEAKER: *The compactness estimates for Hamilton-Jacobi equations.*
- 05.2013 Functional Analysis and Applications, SISSA.
  SEMINAR: *The compactness estimates for Hamilton-Jacobi equations.*
- 04.2013 Deparment of information Engineering, Computer Science and Mathematics, University of L'Aquila
  SEMINAR: *The compactness estimates for Hamilton-Jacobi equations.*
- 07.2012 University of Natural Sciences, HCM, Vietnam
  SEMINAR: *Lower compactness estimates for scalar balance laws.*
- 12.2012 Department of Mathematics and Computer Sciences, University of Verona
  SEMINAR: *Time optimal control*
- 03.2012 Department of Mathematics, University of Rome "Tor Vergata"
  SEMINAR: *Lower compactness estimates for scalar balance laws.*
- 09.2011 The SADCO Summer School on Control and Optimization, Imperial College London.
  INVITED SPEAKER: *Some regularity results for a class of upper semicontinuous functions and time optimal control.*
- 04.2011 Functional Analysis and Applications, SISSA.
  SEMINAR: *The regularity of the minimum time function via nonsmooth analysis and geometric measure theory.*
- 07.2010 Control of Partial Differential Equations
  Centro Internazionale Matematico Estivo-International Mathematical Summer Center, July 19-23.
  COMMUNICATION: *The regularity of the minimum time function via nonsmooth analysis and geometric measure theory.*
- 01.2009 Calculus of Variations and Partial Differential Equations
  Department of Mathematics "Ulisse Dini", Firenze, January 23-24.
  INVITED SPEAKER: *Quantitative isoperimetric and Sobolev inequalities for a class of nonconvex sets and functions.*

Contributed talks

- 05.2015 Workshop on Interdisciplinary Mathematics, May 8 - 10, 2015, PSU mathematics departments
  TALK: *Conservation laws and some applications to traffic flows.*

- 06.2012 — The fourteenth international conference on hyperbolic problems: Theory numerics and Applications, University of Padova, Italy.
  Talk: *Lower compactness estimates for scalar balance laws.*
- 05.2011 — Nonlinear Hyperbolic PDEs, Dispersive and Transport Equations: Analysis and Control, SISSA.
  Talk: *Lower compactness estimates for scalar balance laws.*

Synergistic activities

- Summer 2015 — Organizer of the summer Meeting 2015, University of Sciences, Ho Chi Minh city, Vietnam, August 8–9, 2015.
- Summer 2012 — Participate to organize the fourteenth international conference on hyperbolic problems: Theory numerics and Applications, University of Padova, Italy.
- 2011 – 2014 — A member of Padova team in the European Marie Curie research network SADCO.
- 2009 – 2013 — Member of Gruppo di Ricerca europeo Italo Francese sul Controllo delle Equazioni a Derivate Parziali (GDRE-CONEDP).
- 2010 – 2013 — Member of Ateneo project
  Some analytic and differential geometric aspects in Nonlinear Control Theory, with applications to Mechanic.
- 2008 – 2013 — Member of the Padova research group of the MIUR PRIN project
  "Metodi di viscosità, geometrici e di controllo per modelli diffusivi nonlineari" (Viscosity, gemetrical and control methods for nonlinear diffusive models) in the field of Partial Differential Equations.
- 2007 — Coordinator for the 48th International Mathematical Olympiad (IMO), Vietnam, 2007.
- 2010–present — Referee for SIAM Journal on Control and Optimization (SICON), Mathematical Control and Related Fields (MCRF) - AIMS and Journal of Convex Analaysis.