Curriculum of Andrea Davini

General Informations

position: Associate Professor of Mathematical Analysis, Università di Roma *La Sapienza*,

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Positions

2019 - today Associate Professor, Dipartimento di Matematica "G. Castelnuovo", Università di Roma *La Sapienza*.

2018 National Scientific Qualification to cover a Full Professor position in Mathematical Analysis (expiring date: July 2029).

Qualification à Professeur des Universités (France) for Sections 25 (Mathématiques) and 26 (Mathématiques appliquées et applications des mathématiques)

2007 - 2018 Assistant Professor, Dipartimento di Matematica "G. Castelnuovo", Università di Roma *La Sapienza*.

2006 - 2007 Marie Curie post-doc position (*Marie Curie Intra European Fellowship*) at UMPA, École Normale Supérieure de Lyon (France), (October 2006 – April 2007).

2005 - 2006 Post-doc position at the Dipartimento di Matematica Pura ed Applicata, Università di Padova (October 2005 – September 2006).

2004 - 2005 Post-doc position at the Dipartimento di Matematica Pura ed Applicata, Università di Pisa (January 2004 – September 2005).

Education

2001 - 2003 Ph.D. student in Mathematics at the Dipartimento di Matematica, Università di Pisa (January 2001 – December 2003).

Title of the thesis (defended in May 2004): *Finsler metrics in Optimization Problems and Hamilton-Jacobi equations.*
Advisor: prof. Giuseppe BUTTAZZO

1999 - 2000 Fellowship sponsored by Istituto Nazionale di Alta Matematica within a program for doctoral studies abroad. Attending the courses of D.E.A. *Equationes aux Dérivées Partielles et Calcul Scientifique* at the University of Paris 11 (October 1999 – September 2000).

1995 - 1999 Undergraduate student in Mathematics at the Università di Pisa.

Degree *cum laude* in Mathematics at the Università di Pisa.

Title of the thesis (defended on September 30, 1999): *Calibrations for minimal surfaces and singular cones.*
Advisor: prof. Giovanni ALBERTI

1992 -1995 Undergraduate student in Engineering, Università di Pisa.

Teaching

2022 - 2023 *Istituzioni di Matematica 1* (first–year course in calculus for students of Chemistry, 90 hours) and *Analisi Superiore* (second–year of the Master Degree in Mathematics and Applied Mathematics, 48 hours), Università di Roma *La Sapienza*.

2021 - 2022 *Istituzioni di Matematica 1* (first–year course in calculus for students of Chemistry, 120 hours), Università di Roma *La Sapienza*.

2020 - 2021 *Istituzioni di Matematica I* (first–year course in calculus for students of Chemistry, 120 hours) and *Istituzioni di Matematica II* (first–year course in calculus for students of Chemistry, 20 hours), *Sapienza* Università di Roma.

2019 - 2020 *Istituzioni di Matematica II* (first–year course in calculus for students of Chemistry, 40 hours) and *Analisi Matematica 1* (first–year cours of the Bachelor Degree in Mathematics, 90 hours), *Sapienza* Università di Roma.

2018 - 2019 *Istituzioni di Matematica II* (first–year course in calculus for students of Chemistry, 60 hours) and *Calcolo integrale* (first–year course of the Bachelor Degree in Computer Science, 60 hours) , *Sapienza* Università di Roma.

2017 - 2018 *Analisi Reale* (third–year course of Real Analysis for students of Mathematics, 72 hours), Università di Roma *La Sapienza*.

2016 - 2017 *Istituzioni di Analisi Superiore* (course of Real Analysis for Master students in Mathematics, 72 hours), Università di Roma *La Sapienza*.

Recitation classes for *Istituzioni di Matematica 1* (first–year course in calculus for students of Chemistry, 36 hours), Università di Roma *La Sapienza*.

2015 - 2016 *Istituzioni di Analisi Superiore* (course of Real Analysis for students of Mathematics, 72 hours), Università di Roma *La Sapienza*.

2013 - 2015 *Istituzioni di Matematica 2* (second–year course in calculus for students of Architecture, 50 hours), Università di Roma *La Sapienza*.

2012 - 2013 *Equazioni Differenziali Nonlineari* (fifth–year course in Nonlinear PDEs for students in Mathematics, 48 hours), Università di Roma *La Sapienza*.

2011 - 2012 *Analisi* (first–year course in calculus for students in Physics, 90 hours), Università di Roma *La Sapienza*.

2010 - 2011 Recitation classes for *Analisi* (first–year course in calculus for students in Physics), Università di Roma *La Sapienza*.

2009 - 2010 *"Istituzioni di Matematica"* (basic calculus for students in Natural Science, 72 hours), Università di Roma *La Sapienza*.

"Omogeneizzazione per equazioni di Hamilton–Jacobi", course for the Ph.D. in Mathematics (30 hours), Università di Roma *La Sapienza*.

2008 - 2009 *"Calcolo Differenziale"* (basic calculus for students in Computer Science, 48 hours), Università di Roma *La Sapienza*.

2007 - 2008 Recitation classes for *Analisi* (first–year course in calculus for students in Physics), Università di Roma *La Sapienza*.

2005 - 2006 Recitation classes for *Matematica 1* (basic calculus for students in Engineering), Università di Padova (course held by Prof. G.P. Leonardi).

2004 - 2005 Recitation classes for *Analisi Matematica 1* (basic calculus for students in Engineering), Università di Pisa (course held by Prof. H. Beirão da Veiga).

2003 - 2004 Recitation classes for *Analisi Matematica 1* (basic calculus for students in Engineering), Università di Pisa (course held by Prof. H. Beirão da Veiga).

Supervision of Master and Bachelor Theses

◦ M. Scappaticci, *Teoria ergodica e ottimizzazione*, Laurea Magistrale in Matematica per le Applicazioni, March 2019.

◦ B. Reatini, *Lebesgue measure theory*, Bachelor Thesis in Mathematics, March 2012.

◦ R. Scarpellino, *Hamilton-Jacobi equations and minimal time function*, Master Thesis in Applied Mathematics, March 2014.

◦ S. De Angelis, *Metric formulae for Hamilton-Jacobi equations*, Master Thesis in Applied Mathematics, March 2014.

Research

Mini–courses

- **June 2022.** *Random Lax–Oleinik semigroups for Hamilton-Jacobi systems,* on-line course (8h), (Beijing/Shangai University) (China).
- **March 2017.** *Weak KAM Theory for Hamilton-Jacobi systems* (4h), Nanjing University (China) (March 9–10, 2017).
- **Gennaio 2017.** *Aubry Theory for systems of weakly coupled Hamilton-Jacobi equations* (4h). In the conference *Beyond Hamilton-Jacobi, Last call to Bordeaux*, Université de Bordeaux (France) (January 9–13, 2017).
- **January 2013.** Aubry sets for weakly coupled systems of Hamilton-Jacobi equations (3h). *Tutorial Workshop on Weak KAM Theory and Related Topics*, The University of Tokyo (Japan) (January 15–18, 2013).

- **October 2010.** *Weak KAM Theory and homogenization of Hamilton–Jacobi equations* (8h), in the thematic semester *Sistemas Dinámicos y geometría: tres aproximaciones*, Instituto de Matemática Interdisciplinar, Universidad Complutense de Madrid, Madrid (Spain) (October 25–29, 2010).

Recent invited talks

2023

- *On the vanishing discount approximation for compactly supported perturbations of periodic Hamiltonians*, Nonlinear partial differential equations: theory, numerics and applications, Roma, 24-26 May 2023.
- *On the vanishing discount approximation for compactly supported perturbations of periodic Hamiltonians*, Dipartimento di Matematica, Università di Roma "La Sapienza", May 15, 2023.
- *On the vanishing discount approximation for compactly supported perturbations of periodic Hamiltonians*, Recent trends in optimal control and partial differential equations, Pisa, 8-10 May 2023.

2020

- *On the vanishing discount problem from the negative direction*, Nanjing University, (Cina), Zoom seminar, 17 Novembre 2020.

2019

- *The vanishing discount problem for HJ-systems,* New trends in Hamilton-Jacobi: PDE, Control, Dynamical Systems and Geometry, Fudan University, Shanghai (Cina), 1–6 Luglio 2019.
- *Convergenza delle soluzioni per equazioni di Hamilton–Jacobi con fattore di sconto evanescente*, XXI Congresso U.M.I., Pavia, 2–7 settembre 2019.

2018

- *Stochastic homogenization of viscous and non–viscous HJ equations with nonconvex Hamiltonians,* LMS Durham Symposium, Durham (UK), August 20–24, 2018.
- *Weak KAM Theory for Hamilton-Jacobi systems*, Rio ICM Satellite Conference Weak KAM, PUC, Rio de Janeiro (Brazil) , July 23–27, 2018.

2017

- *Homogenization of viscous and non–viscous HJ equations in random media*, Università degli Studi di Padova, May 25, 2017.
- *Convergence of the solutions of discounted Hamilton-Jacobi systems*, Nanjing University, (Cina), March 16, 2017.

2016

- *Convergence of the solutions in the ergodic approximation of the HJ equation*, at the conference *Hamilton-Jacobi Equations: new trends and applications*, Rennes (France), May 2016.
- *Convergence of the solutions of the discounted H-J equation*, Dipartimento di Matematica, Università degli Studi di Roma "Tor Vergata", May 2016.
- *Convergence of the solutions of the discounted H-J equation*, Dipartimento di Matematica, Università di Roma "La Sapienza", February 2016.

2014

- *On a selection principle in the ergodic approximation of the Hamilton-Jacobi equation*, in the thematic trimester *Homogenization and Random Phenomenon* at Mittag–Leffler Institut, Stockholm, October 2014.
- *Convergence of the solutions of the discounted equation,* at the conference *Calculus of variations and optimization. A conference to celebrate the 60th birthday of Giuseppe Buttazzo*, Pisa, May 2014.
- *Convergence of the solutions of the discounted equation,* Dipartimento di Matematica e Fisica, Università di Roma 3, May 2014.
- *Convergence of the solutions of the discounted equation,* in the workshop *Beyond Hamilton–Jacobi in Avignon,* Avignon (France), April 23–30, 2014.
- *Convergence of the solutions of the discounted equation,* Dipartimento di Matematica Pura e Applicata, Università di Padova (Italy), April 2014.
- *Convergence of the solutions of the discounted equation,* Laboratoire de Mathématiques J.A. Dieudonné, Université de Nice Sophia Antipolis (France), April 2014.

2013

- *Convergence of solutions in the ergodic approximation of the Hamilton-Jacobi equation,* MSI Colloquium, ANU, Canberra (Australia), December 2013.

2012

- *Strict critical subsolutions and Aubry set in the stationary ergodic setting,* Institut de Mathématiques de Jussieu, Université Pierre et Marie Curie, Paris (France), May 11, 2012.

2011

- Weak KAM Theory topics for stationary ergodic Hamiltonians in *Dynamical Optimization in PDE and Geometry*, Institut de Mathématiques Université Bordeaux 1 (France), December 12–21, 2011.
- Weak KAM Theory topics for stationary ergodic Hamiltonians in *Nonlinear Dynamics in Partial Differential Equations*, Kyushu University, Fukuoka (Japan), September 12–21, 2011.

Invited visits abroad

◦ Invitation as Research Member to the MSRI Semester *Hamiltonian systems, from topology to applications through analysis* (August 13, 2018 to December 14, 2018, Berkeley) for the period September 13 - December 14, 2018.

◦ CIMAT at Guanajuato (Mexico), July 4–14, 2017. Invited by Prof. Renato ITURRIAGA.

◦ Institut de Mathématiques de Jussieu, Université Pierre et Marie Curie, Paris (France), April 3–7, 2017. Invited by dr. Maxime ZAVIDOVIQUE.

◦ Nanjing University (Cina), March 4–17, 2017. Invited by Prof. Wei CHENG.

◦ CUNY and Baruch College (New York), March 30–April 6, 2016. Invited by Prof. Elena KOSYGINA.

◦ Professeur Invité at the Institut de Mathématiques de Jussieu, Université Pierre et Marie Curie, Paris (France), May 5–June 5, 2015.

∘ CIMAT at Guanajuato (Mexico), March 30–April 28, 2015. Invited by Prof. Gonzalo CONTRERAS.

∘ Mittag–Leffler Institute, thematic trimester in *Homogenization and Random Phenomenon*, September 17th–November 1st, 2014, Stockholm (Sweden). Invited by Prof. Ari LAPTEV.

∘ MSI, Australian National University, Canberra (Australia), November 18–December 20, 2013. Invited by Prof. Xu–Jia WANG.

∘ UMPA, École Normal Supérieure de Lyon, Lyon (France), May 6–10, 2013. Invited by Prof. Albert FATHI.

∘ Institut de Mathématiques de Jussieu, Université Pierre et Marie Curie, Parigi (France), May 7–18, 2012. Invited by dr. Maxime ZAVIDOVIQUE.

∘ Unité de mathématiques pures et appliquées, ENS di Lione (France), April 12–16, 2010. Invited by Prof. Albert FATHI.

∘ IMPA, Rio de Janeiro (Brazil), May 11–30, 2008. Invited by prof. Hermano FRID.

Organization of scientific events

∘ Organizzatore del Convegno *The Hamilton-Jacobi equation in nonlinear PDEs, dynamics and optimal control: a celebration of Antonio Siconolfi's 70th birthday* (Roma, 5–6 maggio, 2022).

∘ Co–organizer of the workshop *From Optimal Control to Maximum Principle* (Agropoli, September 12–14, 2018).

∘ Co–organizer of the INdAM workshop *The Hamilton-Jacobi equation: at the crossroads of PDE, dynamical systems and geometry* (Cortona, June 22-27, 2015).

Publications

1 Capuzzo-Dolcetta, I., Davini, A., On the vanishing discount approximation for compactly supported perturbations of periodic Hamiltonians: the 1d case, *Comm. Partial Differential Equations* (2023), *Comm. Partial Differential Equations* 48 (2023), no. 4, 576-622.

2 Davini, A., Kosygina, E., Stochastic homogenization of a class of nonconvex viscous HJ equations in one space dimension, *J. Differential Equations* 333 (2022), 231–267.

3 Davini, A., Ishii, H., Iturriaga, R., Sánchez–Morgado, H., Discrete approximation of the viscous Hamilton–Jacobi equation, *Stoch. Partial Differ. Equ. Anal. Comput.* 9 (2021), no. 4, 1081–1104.

4 Davini, A., Garmendia, J. L. P., Iturriaga, R., Pardo, J.-L., Sánchez–Morgado, H., Discrete approximation of stochastic Mather measures. *Proc. Amer. Math. Soc.* (2023), in press.

5 Davini, A., Wang, L., On the vanishing discount problem from the negative direction. *Discrete Contin. Dyn. Syst.*, 41 (2021), no. 5.

[6] Davini, A., Zavidovique, M., Convergence of the solutions of discounted Hamilton–Jacobi systems. *Adv. Calc. Var.*, 14 (2021), no. 2, 193–206.

[7] Davini, A., Existence and uniqueness of solutions to parabolic equations with superlinear Hamiltonians. *Commun. Contemp. Math.*, 21 (2019), no. 1.

[8] Davini, A., Siconolfi, A., Zavidovique, M., Random Lax–Oleinik semigroups for Hamilton–Jacobi systems. *J. Math. Pures Appl.* (9) 120 (2018), 294–333.

[9] Davini, A., Kosygina, E., Homogenization of viscous and non-viscous HJ equations: a remark and an application. *Calc. Var. Partial Differential Equations,* 56 (2017), no. 4, 56–95.

[10] Davini, A., Fathi, A., Iturriaga, R., Zavidovique, M., Convergence of the solutions of the discounted equation: the discrete case. *Math. Z.* 284 (2016), no. 3-4, 1021–1034.

[11] Davini, A., Fathi, A., Iturriaga, R., Zavidovique, M., Convergence of the solutions of the discounted Hamilton–Jacobi equation. *Invent. Math.* 206 (2016), no. 1, 29–55.

[12] Davini, A., Siconolfi, A. Existence and regularity of strict critical subsolutions in the stationary ergodic setting. *Ann. Inst. H. Poincaré Anal. Non Linéaire* 33 (2016), no. 2, 243–272.

[13] Davini, A., Zavidovique, M., On the (non) existence of viscosity solutions of multi–time Hamilton–Jacobi equations. *J. Differential Equations* 258 (2015), no. 2, 362–378.

[14] Davini, A., Zavidovique, M. Aubry sets for weakly coupled systems of Hamilton–Jacobi equations. *SIAM J. Math. Anal.* 46 (2014), no. 5, 3361–3389.

[15] Davini, A., Zavidovique, M. Weak KAM theory for nonregular commuting hamiltonians. *Discrete Contin. Dyn. Syst. Ser. B 18* (2013), no. 1, 57–94.

[16] Davini, A., Siconolfi, A. Weak KAM Theory topics in the stationary ergodic setting. *Calc. Var. Partial Differential Equations 44* (2012), 3-4, 319–350.

[17] Davini, A., Siconolfi, A. Metric techniques for convex stationary ergodic Hamiltonians. *Calc. Var. Partial Differential Equations 40* (2011), , 3-4, 391–421.

[18] Davini, A., Siconolfi, A. Exact and approximate correctors for stochastic Hamiltonians: the 1-dimensional case. *Math. Ann. 345* (2009), no. 4, 749–782.

[19] Davini, A. Integral representation of abstract functionals of autonomous type. *Proc. Roy. Soc. Edinburgh Sect. A 138* (2008), no. 4, 725–754.

[20] Davini, A., Ponsiglione, M. Homogenization of two-phase metrics and applications. *J. Anal. Math. 103* (2007), 157–196.

[21] Davini, A. Bolza problems with discontinuous Lagrangians and Lipschitz-continuity of the value function. *SIAM J. Control Optim. 46* (2007), no. 5, 1897–1921.

[22] Davini, A., Siconolfi, A. A generalized dynamical approach to the large time behavior of solutions of Hamilton-Jacobi equations. *SIAM J. Math. Anal. 38* (2006), no. 2, 478–502.

[23] Briani, A., Davini, A. Monge solutions for discontinuous Hamiltonians. *ESAIM Control Optim. Calc. Var. 11*, 2 (2005), 229–251 (electronic).

[24] Davini, A. Smooth approximation of weak Finsler metrics. *Differential Integral Equations 18* (2005), no. 5, 509–530.

[25] Davini, A. On the relaxation of a class of functionals defined on Riemannian distances. *J. Convex Anal. 12* (2005), no. 1, 113–130.

[26] Buttazzo, G., Davini, A., Fragalà, I., Macià, F. Optimal Riemannian distances preventing mass transfer. *J. Reine Angew. Math. 575* (2004), 157–171.

[27] Davini, A. On calibrations for Lawson's cones. *Rend. Sem. Mat. Univ. Padova 111* (2004), 55–70.

Preprint

[28] Davini, A., Stochastic homogenization of quasiconvex degenerate viscous HJ equations in 1d, *Preprint* (2023).

[29] Davini, A., Kosygina, E., Yilmaz, A., Stochastic homogenization of nonconvex viscous Hamilton-Jacobi equations in one space dimension, *ArXiv e-print* (2023).

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