

Curriculum vitæ

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personalia	<i>Name:</i> <u>Klas</u> Erik Finn Modin	
affiliation	Department of Mathematical Sciences Chalmers University of Technology and University of Gothenburg Chalmers Tvärgata 3 SE-412 96 Göteborg Office phone: +46(0)31-772 35 22 <i>E-mail:</i> klas.modin@chalmers.se <i>Web:</i> klasmodin.github.io <i>ORCID:</i> 0000-0001-6900-1122	
education	<i>PhD</i> , Mathematics Lund University, Sweden Title: Adaptive Geometric Numerical Integration of Mechanical Systems Supervisors: Claus Führer and Gustaf Söderlind	May 2010
	<i>Master of Science</i> , Mathematics Lund University, Sweden	Feb 2004
academic positions	Professor, <i>Chalmers University of Technology</i>	Since Nov 2020
	Associate Professor, <i>Chalmers University of Technology</i>	Nov 2017–Oct 2020
	Assistant Professor, <i>Chalmers University of Technology</i>	Nov 2013–Oct 2017
	Post-doc, <i>University of Toronto</i> , Canada Funded by the Swedish Research Council .	Jul 2012–Jun 2014
	Post-doc, <i>Massey University</i> , New Zealand Funded by the Marsden Fund and the Royal Physiographical Society in Lund .	Jul 2009–Jan 2012
other positions	Numerical Analyst, <i>SKF Sverige AB</i> , Göteborg Employment on a project basis.	2004–2005
invitations as guest researcher	University of Toronto, Canada (host: Boris Khesin)	Feb 2020
	Massey University, New Zealand (host: Robert McLachlan)	Jan–Apr 2018
	Massey University, New Zealand (host: Robert McLachlan)	Jan–Mar 2016
	Imperial College, UK (host: Darryl Holm)	Oct 2013
	University of Vienna, Austria (host: Peter Michor)	May 2013
	Imperial College, UK (host: Darryl Holm)	Apr 2012
	NTNU, Norway (host: Brynjulf Owren)	Feb–Mar 2012
workshop organizer at research institutes	Sophus Lie Conference Center for Mathematics, Norway	Jul 2024
	Banff International Research Station (BIRS), Canada	Nov 2023
	Institute Mittag-Leffler (IML), Stockholm, Sweden	July 2018

invitations to research institutes	Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany	Jan 2027
	Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany	May 2026
	International Centre for Mathematical Sciences (ICMS), Edinburgh, UK	Jun 2025
	Gran Sasso Science Institute (GSSI), L'Aquila, Italy	May 2025
	Erwin Schrödinger Institute (ESI), Vienna, Austria	Feb 2025
	Centre International de rencontres mathématiques (CIRM), Luminy, France	May 2024
	Institute Mittag-Leffler (IML), Stockholm, Sweden	Nov 2023
	Max Planck Institute (MPL), Leipzig, Germany	Apr 2023
	Simon Center for Geometry and Physics (SCGP), New York, USA	Jul 2022
	International Center for Mathematical Science (ICMS), Edinburgh, UK	Apr 2021
	Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany	Mar 2021
	Fields Institute (FI), Toronto, Canada	Sep 2020
	Princeton Center of Theoretical Sciences (PCTS), Princeton, USA	Feb 2020
	Hausdorff Research Institute (HIM), Bonn, Germany	Nov 2019
	Isaac Newton Institute (INI), UK	Nov 2019
	Banff International Research Station (BIRS), Canada	Dec 2018
	Isaac Newton Institute (INI), UK	Nov 2017
	Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany	Mar 2016
	Erwin Schrödinger Institute (ESI), Vienna, Austria	Jan 2015
	Simon Center for Geometry and Physics (SCGP), New York, USA	May 2014
	Fields Institute (FI), Toronto, Canada	Jul–Aug 2012

tutoring experience

Supervision of Post-docs

Geir Bogfjellmo (2015–2017)
Sagy Ephrati (2023–2025)
Eugen Bronasco (2025–2027)

Supervision of PhD students

Michael Roop (2021–today)
Erik Jansson (2020–2025)
Milo Viviani (2015–2020)

Co-supervision of PhD students

currently: 2
past: 3

Supervision of master students

Chalmers and GU: 16
ENS Paris: 3

Pedagogical training

2024. Chalmers EER course “Diversity and Inclusion for Learning” (3 ECTS).

2014–2020. Chalmers “Diploma of Higher Education” (17 ECTS).

Undergraduate teaching

2019–today. Developing and teaching course on “[Architectural Geometry](#)”.

2018–2023. Developing and teaching course on “[Scientific Visualization](#)”.

2014–today. Basic calculus courses at Chalmers. (Teacher and examiner.)

2010–2012. Various mathematics courses at Massey. (Teacher and examiner.)

Post-graduate teaching

2025. Mini-course on “[Information geometry of diffeomorphism groups](#)” at the Erwin Schrödinger Institute, Vienna, Austria, February 3–7, 2025.

2024. Course on “[Numerical Methods for ODEs](#)” at Chalmers and GU.

2023. Mini-course on “[Geometric Hydrodynamics on Flatland](#)” at the University of Santiago de Compostella, Spain, September 4–8, 2023.

2018. Mini-course on “[Geometric Hydrodynamics](#)” at the University of Coimbra, Portugal, December 6–8, 2018.

2013. Course on “Geometric Numerical Integration” at Chalmers and GU.

Written lecture notes

2013. “[Geometric Mechanics and Geometric Integration](#)”.

Selection of honours and grants

2026. *Plenary speaker*, Foundations of Computational Mathematics (FoCM), Vienna, July 2026.

2025. *Göran Gustafsson Award in Mathematics*, Göran Gustafsson Foundation.

2024. *Wallenberg Academy Fellow (extension)*, Knut and Alice Wallenberg Foundation (KAW).

2024. *International post-doc recruitment grant*, Knut and Alice Wallenberg Foundation (KAW).

2022. *Project Grant*, Swedish Research Council (VR).

2019. *Wallenberg Academy Fellow*, Knut and Alice Wallenberg Foundation (KAW).

2017. *Starting Grant*, Swedish Research Council (VR).

2015. *International post-doc recruitment grant*, Knut and Alice Wallenberg Foundation (KAW).

2015. *Stenbäckska Stipendiet*, Finnish Society of Sciences and Letters.

2015. *Marie Skłodowska-Curie Individual Fellowship*, EU Horizon 2020.

2015. *Transition Grant*, Swedish Foundation for International Cooperation in Research and Higher Education (STINT).

2013. *Ingvar Carlsson Award*, Swedish Foundation of Strategic Research (SSF).

2012. *International Post-doc grant*, Swedish Research Council (VR).

2010. *Post-doctoral scholarship* Royal Physiographic Society in Lund.
2009. *Travel scholarship* Royal Swedish Academy of Science (KVA).
2007. *Young researcher scholarship* Royal Physiographic Society in Lund.

Peer-reviewed publications

For updates and other publications, see klasmodin.github.io/publications

58. Lichtenfelz, L., Modin, K. & Preston, S. C. Ricci curvature for hydrodynamics on the sphere. *Comm. Math. Phys.* **407**, 37 (2026).
57. Modin, K. & Viviani, M. A brief introduction to matrix hydrodynamics. *J. Comput. Dyn.* **14**, 17–35 (2026).
56. Modin, K. & Viviani, M. Two-dimensional fluids via matrix hydrodynamics. *Arch. Rational Mech. Anal.* **250**, 10 (2026).
55. Ephrati, S., Jansson, E. & Modin, K. On spectral scaling laws for averaged turbulence on the sphere. *Phys. D* **481**, 134808 (2025).
54. Jansson, E., Krook, J., Modin, K. & Öktem, O. Geometric shape matching for recovering protein conformations from single-particle Cryo-EM data. *SIAM J. Imaging Sci.* **18**, 2509–2546 (2025).
53. Jansson, E. & Modin, K. Sub-Riemannian landmark matching and its interpretation as residual neural networks. *J. Comput. Dyn.* **12**, 467–490 (3 2025).
52. Modin, K. & Preston, S. C. Zeitlin’s model for axisymmetric 3-D Euler equations. *Nonlinearity* **38**, 025008 (2025).
51. Modin, K. & Roop, M. Spatio-temporal Lie-Poisson discretization for incompressible magnetohydrodynamics on the sphere. *IMA J. Numer. Anal.*, draf024 (2025).
50. Modin, K. & Suri, A. Geodesic interpretation of the global quasi-geostrophic equations. *Calc. Var. Partial Differential Equations* **65**, 17 (2025).
49. Jansson, E. & Modin, K. Convergence of the vertical gradient flow for the Gaussian Monge problem. *J. Comput. Dyn.* **11**, 1–9 (2024).
48. Khesin, B., Modin, K. & Volk, L. Simple unbalanced optimal transport. *Int. Math. Res. Not.* **2024**, 8839–8855 (10 2024).
47. Modin, K. On the geometry and dynamical formulation of the Sinkhorn algorithm for optimal transport. *J. Comput. Dyn.* **11**, 442–452 (2024).
46. Modin, K. & Perrot, M. Eulerian and Lagrangian stability in Zeitlin’s model of hydrodynamics. *Comm. Math. Phys.* **405**, 177 (2024).
45. Cifani, P., Viviani, M. & Modin, K. An efficient geometric method for incompressible hydrodynamics on the sphere. *J. Comput. Phys.* **473**, 111772 (2023).
44. Khesin, B. & Modin, K. The Toda flow as a porous medium equation. *Comm. Math. Phys.* **401**, 1879–1898 (2023).
43. Maurelli, M., Modin, K. & Schmeding, A. Incompressible Euler equations with stochastic forcing: a geometric approach. *Stochastic Process. Appl.* **159**, 101–148 (2023).
42. Balehowsky, T., Karlsson, C.-J. & Modin, K. Shape analysis via gradient flows on diffeomorphism groups. *Nonlinearity* **36**, 862 (2022).
41. Cifani, P., Viviani, M., Luesink, E., Modin, K. & Geurts, B. Casimir preserving spectrum of two-dimensional turbulence. *Phys. Rev. Fluids* **7**, L082601 (2022).
40. Modin, K. & Viviani, M. Canonical scale separation in two-dimensional incompressible hydrodynamics. *J. Fluid Mech.* **943**, A36 (2022).

39. Khesin, B., Misiolek, G. & Modin, K. Geometric hydrodynamics and infinite-dimensional Newton's equations. *Bull. Amer. Math. Soc.* **58**, 377–442 (2021).
38. Modin, K. & Viviani, M. Integrability of point-vortex dynamics via symplectic reduction: a survey. *Arnold Math. J.* **7**, 357–385 (2021).
37. Bauer, M. & Modin, K. Semi-invariant Riemannian metrics in hydrodynamics. *Calc. Var. Partial Differential Equations* **59**, 65 (2020).
36. Modin, K. & Verdier, O. What makes nonholonomic integrators work? *Numer. Math.* **145**, 405–435 (2020).
35. Modin, K. & Viviani, M. A Casimir preserving scheme for long-time simulation of spherical ideal hydrodynamics. *J. Fluid Mech.* **884**, A22 (2020).
34. Modin, K. & Viviani, M. Lie-Poisson methods for isospectral flows. *Found. Comput. Math.* **20**, 889–921 (2020).
33. Benn, J., Marsland, S., McLachlan, R., Modin, K. & Verdier, O. Currents and finite elements as tools for shape space. *J. Math. Imaging Vis.* **61**, 1197–1220 (2019).
32. Hellsvik, J. *et al.* General method for atomistic spin-lattice dynamics with first-principles accuracy. *Phys. Rev. B* **99**, 104302 (2019).
31. Khesin, B., Misiolek, G. & Modin, K. Geometry of the Madelung transform. *Arch. Rational Mech. Anal.* **234**, 549–573 (2019).
30. Bogfjellmo, G., Modin, K. & Verdier, O. A Numerical Algorithm for C2-splines on Symmetric Spaces. *SIAM J. Numer. Analysis* **56**, 2623–2647 (2018).
29. Khesin, B., Misiolek, G. & Modin, K. Geometric Hydrodynamics via Madelung Transform. *Proc. Natl. Acad. Sci. USA* **115**, 6165–6170 (2018).
28. Modin, K., Nachman, A. & Rondi, L. A Multiscale Theory for Image Registration and Nonlinear Inverse Problems. *Adv. Math.* **346**, 1009–1066 (2018).
27. Bauer, M., Joshi, S. & Modin, K. *Diffeomorphic random sampling using optimal information transport in Nielsen F., Barbaresco F. (eds) Geometric Science of Information. GSI 2017. Lecture Notes in Computer Science, vol 10589. Springer* (2017).
26. Bauer, M., Joshi, S. & Modin, K. On Geodesic Completeness of Riemannian Metrics on Smooth Probability Densities. *Calc. Var. Partial Differential Equations* **56**, 113 (2017).
25. McLachlan, R., Modin, K., Munthe-Kaas, H. & Verdier, O. Butcher series: A story of rooted trees and numerical methods for evolution equations. *Asia Pacific Mathematics Newsletter* **7**, 1–11 (2017).
24. McLachlan, R., Modin, K. & Verdier, O. A minimal-variable symplectic integrator on spheres. *Math. Comp.* **86**, 2325–2344 (2017).
23. Modin, K. Geometry of Matrix Decompositions Seen Through Optimal Transport and Information Geometry. *J. Geom. Mech.* **9**, 335–390 (2017).
22. McLachlan, R., Modin, K., Munthe-Kaas, H. & Verdier, O. B-series methods are exactly the affine equivariant methods. *Numer. Math.* **133**, 599–622 (2016).
21. McLachlan, R., Modin, K. & Verdier, O. Geometry of discrete-time spin systems. *J. Nonlin. Sci.* **26**, 1507–1523 (2016).
20. McLachlan, R., Modin, K. & Verdier, O. Symmetry reduction for central force problems. *Eur. J. Phys.* **37**, 0055003 (2016).
19. Bauer, M., Joshi, S. & Modin, K. Diffeomorphic density matching by optimal information transport. *SIAM J. Imaging Sci.* **8**, 1718–1751 (2015).
18. McLachlan, R., Modin, K. & Verdier, O. Collective Lie-Poisson integrators on R^3 . *IMA. J. Num. Anal.* **35**, 546–560 (2015).
17. Modin, K. Generalized Hunter-Saxton equations, optimal information transport, and factorization of diffeomorphisms. *J. Geom. Anal.* **25**, 1306–1334 (2015).

16. Rottman, C., Bauer, M., Modin, K. & Joshi, S. *Weighted Diffeomorphic Density Matching with Applications to Thoracic Image Registration* in *Proc. 5th MICCAI Workshop on Mathematical Foundations of Computational Anatomy (MFCA)*, Munich, Germany, October 9 (2015).
15. Marsland, S., McLachlan, R., Modin, K. & Perlmutter, M. On conformal variational problems and free boundary continua. *J. Phys. A* **47**, 145204 (2014).
14. McLachlan, R., Modin, K. & Verdier, O. Collective symplectic integrators. *Nonlinearity* **27**, 1525–1542 (2014).
13. McLachlan, R., Modin, K. & Verdier, O. Symplectic integrators for spin systems. *Phys. Rev. E* **89**, 061301 (2014).
12. McLachlan, R., Modin, K., Verdier, O. & Wilkins, M. Geometric Generalisations of SHAKE and RATTLE. *Found. Comput. Math.* **14**, 339–370 (2014).
11. Marsland, S., McLachlan, R., Modin, K. & Perlmutter, M. Geodesic Warps by Conformal Mappings. *Int. J. Comput. Vis.* **105**, 144–154 (2013).
10. McLachlan, R., Modin, K., Verdier, O. & Wilkins, M. Symplectic integrators for index 1 constraints. *SIAM J. Sci. Comput.* **35**, A2150–A2162 (2013).
9. Modin, K. & Verdier, O. Integrability of Nonholonomically Coupled Oscillators. *Discrete Contin. Dyn. Syst.* **34**, 1121–1130 (2013).
8. Marsland, S., McLachlan, R., Modin, K. & Perlmutter, M. *On a Geodesic Equation for Planar Conformal Template Matching* in *Proc. MFCA'11* (2011).
7. Modin, K., Perlmutter, M., Marsland, S. & McLachlan, R. On Euler-Arnold Equations and Totally Geodesic Subgroups. *J. Geom. Phys.* **61**, 1446–1461 (2011).
6. Modin, K. & Söderlind, G. Geometric Integration of Hamiltonian Systems Perturbed by Rayleigh Damping. *BIT Num. Math.* **51**, 977–1007 (2011).
5. Modin, K. Time-transformation and reversibility of Nambu-Poisson systems. *J. Gen. Lie Theory Appl.* **3**, 39–52 (2009).
4. Modin, K. On explicit adaptive symplectic integration of separable Hamiltonian systems. *J. Mult. Body Mech.* **222**, 1464–1493 (2008).
3. Modin, K., Fritzson, D. & Führer, C. *Semiexplicit Numerical Integration by Splitting with Application to Dynamic Multibody Problems with Contacts* in *Proceedings of The 48th Scandinavian Conference on Simulation and Modeling (SIMS 2007)*, Linköping University Electronic Press (2007).
2. Modin, K. & Führer, C. Time-step adaptivity in variational integrators with application to contact problems. *ZAMM Z. Angew. Math. Mech.* **86**, 785–794 (2006).
1. Modin, K., Fritzson, D., Führer, C. & Söderlind, G. *A new class of variable step-size methods for multi-body dynamics* in *Proceedings of Multibody Dynamics 2005, ECCOMAS Thematic Conference, Madrid, June 21-24* (2005).