

Curriculum vitæ

March 28, 2023

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> Associate Professor, <i>Chalmers University of Technology</i> Assistant Professor, <i>Chalmers University of Technology</i> Post-doc, <i>University of Toronto</i> , Canada Funded by the Swedish Research Council. Post-doc, <i>Massey University</i> , New Zealand Funded by the Marsden Fund and the Royal Physiographical Society in Lund.	Since Nov 2020 Nov 2017–Oct 2020 Nov 2013–Oct 2017 Jul 2012–Jun 2014 Jul 2009–Jan 2012
other positions	Numerical Analyst, <i>SKF Sverige AB</i> , Göteborg Employment on a project basis.	2004–2005
invitations to research institutes	Institute Mittag-Leffler (IML), Stockholm, Sweden Max Planck Institute (MPL), Leipzig, Germany Simon Center for Geometry and Physics (SCGP), New York, USA International Center for Mathematical Science (ICMS), Edinburgh, UK Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany Fields Institute (FI), Toronto, Canada Princeton Center of Theoretical Sciences (PCTS), Princeton, USA Hausdorff Research Institute (HIM), Bonn, Germany Isaac Newton Institute (INI), UK Banff International Research Station (BIRS), Canada Isaac Newton Institute (INI), UK Mathematisches Forschungsinstitut Oberwolfach (MFO), Germany Erwin Schrödinger Institute (ESI), Vienna, Austria Simon Center for Geometry and Physics (SCGP), New York, USA Fields Institute (FI), Toronto, Canada	Nov 2023 Apr 2023 Jul 2022 Apr 2021 Mar 2021 Sep 2020 Feb 2020 Nov 2019 Nov 2019 Dec 2018 Nov 2017 Mar 2016 Jan 2015 May 2014 Jul–Aug 2012

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	Banff International Research Station (BIRS), Canada	Nov 2023
	Institute Mittag-Leffler (IML), Stockholm, Sweden	July 2018
tutoring experience	<i>Supervision of Post-docs</i>	Geir Bogfjellmo (2015–2017)
	<i>Supervision of PhD students</i>	Michael Roop (2021–today) Erik Jansson (2020–today) Milo Viviani (2015–2020)
	<i>Co-supervision of PhD students</i>	currently: 3 past: 2
	<i>Supervision of master students</i>	Chalmers and GU: 10 ENS Paris: 2
	<i>Pedagogical training</i>	
	2014–today. Chalmers EER courses (17 ECTS).	
	<i>Undergraduate teaching</i>	
	2018. Development of Canvas-based course “Scientific Visualization”.	
	2014–today. Basic calculus courses at Chalmers. (Teacher and examiner.)	
	2010–2012. Various mathematics courses at Massey. (Teacher and examiner.)	
	<i>Post-graduate teaching</i>	
	2013. Course on geometric integration at Chalmers. (Organizer and teacher.)	
	2018. Mini-course on “Geometric Hydrodynamics” at the University of Coimbra, Portugal, December 6–8, 2018.	
	<i>Written lecture notes</i>	
	2013. “Geometric Mechanics and Geometric Integration”.	

Selection of honours and grants

- 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

45. Khesin, B. & Modin, K. The Toda flow as a porous medium equation. *Comm. Math. Phys.* DOI:10.1007/s00220-023-04680-2 (2023).
44. Maurelli, M., Modin, K. & Schmeding, A. Incompressible Euler equations with stochastic forcing: a geometric approach. *Stochastic Process. Appl.* **159**, 101–148 (2023).
43. Balehowsky, T., Karlsson, C.-J. & Modin, K. Shape analysis via gradient flows on diffeomorphism groups. *Nonlinearity* **36**, 862 (2022).
42. Cifani, P., Viviani, M., Luesink, E., Modin, K. & Geurts, B. Casimir preserving spectrum of two-dimensional turbulence. *Phys. Rev. Fluids* **7**, L082601 (2022).
41. Cifani, P., Viviani, M. & Modin, K. An efficient geometric method for incompressible hydrodynamics on the sphere. *J. Comput. Phys.* **473**, 111772 (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. Ration. 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).