

Brynjulf Owren

Department of Mathematical Sciences,
NTNU,
N-7491 Trondheim,
Norway.

Current position:

- Professor at Department of Mathematical Sciences, The Norwegian University of Science and Technology, since January 1994.
- Vice Dean of Education, Faculty of Information Technology, Mathematics, and Electrical Engineering, NTNU, since August 2012.

Main area of research: Numerical analysis of ordinary and partial differential equations, initial value problems, integration methods for differential equations on manifolds (geometric integration). Mathematical modelling.

Academic degrees:

- Doktoringeniør (PhD) in Numerical Analysis at NTH (1990) *Continuous Explicit Runge-Kutta Methods with Applications to Ordinary and Delay Differential Equations*, advisor: Professor S.P. Nørsett.
- Sivilingeniør (Master of Science) in Physics and Mathematics at the Norwegian Institute of Technology (NTH), 1984. Main subject: Numerical mathematics. MSc thesis: *Acoustic response in oil wells* (in Norwegian).

Work experience:

- 1992-1993 Førsteamanuensis (Assistant professor) at Department of Mathematics and Statistics, University of Trondheim
- 1990-1992 Postdoctoral fellow at Department of Computer Science, University of Toronto.
- 1990 Lecturer at the Norwegian Institute of Technology.
- 1987-1989 Ph.D. fellowship from NTH.
- 1986 Research assistant (vitenskapelig assistent) at Department of Mathematical Sciences, NTH.
- 1988-90 Research scientist (forsker), part time, at SINTEF Industrial Mathematics, Trondheim, Norway.
- 1985-1988 Research Geophysicist at SERES A/S, Trondheim, Norway.

Graduate student supervision: 31 M.Sc. students since 1994.

Former Ph.D. students

- Arne Marthinsen 14.05.1999 (co-supervised with Prof. Munthe-Kaas), *Numerical Integration of Ordinary Differential Equations on Manifolds via Lie Group Actions*.
- Roman Kozlov 05.01.2001 (co-supervised with A. Kværnø), *Symmetry Applications to Difference and Differential-Difference Equations*.
- Hallgeir Melbø 17.12.2001, *A Posteriori Error Estimation for Finite Element Methods and Iterative Linear Solvers*.
- Bård Skaflestad 20.12.2005, *Exponential Integrators and Applications to the Incompressible Navier-Stokes Equations*.
- Bjarte Hægland 02.06.2006, *Computational methods for handling incompressible fluid flows involving internal density interfaces and boundary layers*.
- Håvard Berland 15.09.2006, *Lie group and exponential integrators: theory, implementation and applications*.
- Andreas Asheim 24.06.2010 (co-supervised with Prof. Nørsett), *Numerical methods for highly oscillatory problems*.

Morten Dahlby 25.11.2011, *Integral-Preserving Numerical Methods for Differential Equations*.

Current Ph.D. students: Håkon Marthinsen (from Aug 1, 2009), Geir Bogfjellmo (From Aug 1, 2011), Manuel Amaya Benitez (from October 1, 2012).

Memberships, leadership experience etc

- Vice Dean of Education, Faculty of Information Technology, Mathematics and Electrical Engineering, NTNU, 2012–
- Member of the Executive Committee for Engineering Education at NTNU. 2012–
- Member of Administrative Council of SEFI (European Society for Engineering Education)
- Leader of specialisation in Industrial Mathematics, Department of Mathematical Sciences, NTNU 2004-2007, and of study programme in Physics and Math, NTNU, 2008-2012
- President of the Norwegian Mathematical Society 2007–2011 (board member since 2004)
- Council member of ECMI 2007–2011 (European Consortium for Mathematics in Industry).
- Leader of Research Program in Computational Science and Visualization at NTNU, 2005/2006.
- Member of NTVA (The Norwegian Academy of Technological Sciences) since 2005.
- Member of DKNVS (The Royal Norwegian Society of Sciences and Letters) since 2008.
- Leader of special year in Geometric Integration, Center for Advanced Study, Oslo, 2002-2003 (coorganised with Prof Munthe-Kaas, University of Bergen)
- Board member of Sintef Applied Mathematics, 2000-2003

Research projects.

SYNODE I+II. The Research Council of Norway, 1996–2001. Main author of applications. Supervised 2 Ph.D. students

CSE. Strategic University Programme, The Research Council of Norway. 1997–2003. Subproject leader and main author of application. Project funded 9 Ph.D. students.

STRATOS. The Research Council of Norway, 2000-2005. Project leader. Funded 3 Ph.D. students and 2 postdocs.

GALA. EU Sixth Framework Programme, STREP project 2006–2009. Leader for Trondheim node.

3D CSEM. *Inversion and Modeling* 2012–2015. Joint project between NTNU and the company EMGS.

SPIRIT. *Structure Preserving Integrators, discRete Integrable systems and algebraic combinaTories*. The Research Council of Norway, 2013–2017, Project leader.

Some recent invited talks.

ICNAAM 2011. 9th International Conference of Numerical Analysis and Applied Mathematics, Halkidiki, Greece, September 2011. Invited speaker.

FoCM 2011. Foundations of Computational Mathematics, Budapest, Hungary, July 2011. Invited talk in workshop on Geometric Integration.

International Conference of Sub-Riemannian Geometry and Vision, Bologna, Italy, September 2009. Invited plenary speaker.

ICCAM 2008. International Congress on Computational and Applied Mathematics, Gent, Belgium, July 2008. Invited plenary speaker

Selected publications

47. Celledoni E., Owren B., *Preserving first integrals with symmetric Lie group methods*, Discrete and Continuous Dynamical Systems - Series A **234**(3), (2014) 977–990.
46. Celledoni E., Owren B., Sun Y., *The minimal stage, energy preserving Runge-Kutta method for polynomial Hamiltonian systems is the Averaged Vector Field method*, Mathematics of Computation (2014). doi: <http://dx.doi.org/10.1090/S0025-5718-2014-02805-6>
45. Celledoni E., Marthinsen H., Owren B., *An introduction to Lie group integrators .. basics, new developments and applications*. J. Comput. Phys. **257** (2014), 1040–1061.
44. Celledoni E., McLachlan R. I., Owren B., Quispel G. R. W., *Geometric Properties of Kahan's Method*, J. Phys. A. **46** (2013)
43. Celledoni E., Grimm V., McLachlan R.I., McLaren D.I., O'Neale D., Owren B., and Quispel G.R.W., *Preserving energy resp. dissipation in numerical PDEs using the "Average Vector Field" method*, Journal of Computational Physics **231** (2012) 6770–6789.
42. Dahlby M., and Owren B., *A General Framework for Deriving Integral Preserving Numerical Methods for PDEs*, SIAM J. Sci. Comput. **33** (2011), 2318–2340.
41. Dahlby M., Owren B., and Yaguchi T., *Preserving multiple first integrals by discrete gradients*, J. Phys. A. **44** (2011).
40. Celledoni E., McLachlan R. I., Owren B., Quispel G. R. W., *On conjugate B-series and their geometric structure*, J. Numer. Anal. Ind. Appl. Math. **5** (2011), 85–94.
39. Christiansen S., Munthe-Kaas H., and Owren B., *Topics in Structure Preserving Discretization*, Acta Numerica **20** (2011), 1–119.
38. Celledoni E., McLachlan R.I., Owren B. and Quispel G.R.W., *Energy-preserving integrators and the structure of B-series*. Found. Comput. Math. **10** (2010), 673–693
37. Celledoni E., McLachlan R.I., Owren B. and Quispel G.R.W., *On conjugate B-series and their geometric structure*. Journal on Numerical Analysis Industrial and Applied Mathematics **5** (2010), 85–90.
36. Celledoni E., McLachlan R.I., Owren B. and Quispel G.R.W., *Structure of B-series for some classes of geometric integrators*, AIP Conference Proceedings **1168** (2009), 739–742.
35. Celledoni E., McLachlan R.I., McLaren D.I., Owren B., Quispel G.R.W. and Wright W. *Energy-preserving Runge-Kutta methods*, ESAIM: M2AN **43** (2009), 645–649.
34. Dahlby M.L. and Owren B., *Plane wave stability of some conservative schemes for the cubic Schrödinger equation*, ESAIM: M2AN **43** (2009), 677–687.
33. Celledoni E., Cohen D. and Owren B., *Symmetric exponential integrators with an application to the cubic Schrödinger equation*. Found. Comput. Math. **8** (2008), 303–317.
32. Cohen D., Owren B. and Raynaud X., *Multi-symplectic integration of the Camassa-Holm equation*. J. Comput. Phys. **227** (2008), 5492–5512.
31. Berland H., Owren B., Skaflestad B., *Solving the nonlinear Schrödinger equation using exponential integrators*. Modeling, Identification and Control, **27** (2006), 201–217,
30. Owren B., *Order conditions for commutator-free Lie group methods*, J. Phys. A **39** (2006), 5585–5599.
29. Berland H., Owren B. and Skaflestad B. *B-series and order conditions for exponential integrators*. SIAM J. Numer. Anal. **43** (2005), 1715–1727.
28. Berland H. and Owren, B., *Algebraic structures on ordered rooted trees and their significance to Lie group integrators*. Group theory and numerical analysis, 49–63, CRM Proc. Lecture Notes, **39** (2005), Amer. Math. Soc.
27. Kozlov R., Kværnø A., Owren B., *The local behaviour of splitting methods applied to stiff problems*, Journal of Computational Physics, **195**/2 (2004) 576–593.
26. Celledoni E., Owren B., *On the implementation of Lie group methods on the Stiefel manifold*, Numer. Alg. **32** (2003) 163–183.

25. Celledoni E., Marthinsen A. and Owren B., *Commutator-free Lie group methods*, Future Generation Computer Systems **19** (2003) 341–352.
24. Celledoni E. and Owren B.: *Lie group methods for rigid body dynamics and time integration on manifolds*, Comput. Meth. Appl. Mech. Engrg. **192** (2003), 421–438.
23. Casas F. and Owren B., *Cost efficient Lie group integrators in the RKMK class*, BIT Numerical Mathematics, **43/4** (2003) 723–742.
22. Celledoni E. and Owren B.: *A class of intrinsic schemes for orthogonal integration*, SIAM J. Numer. Anal. **40** (2002), 2069–2084.
21. Owren B., Marthinsen A., *Integration Methods Based on Canonical Coordinates of the Second Kind*, Numer. Math. **87** (2001) 763–790
20. Marthinsen A., Owren B., *Quadrature methods based on the Cayley transform*. Special issue: Themes in geometric integration. Appl. Numer. Math. **39** (2001), no. 3-4, 403–413.
19. Marthinsen A., Owren B., *A note on the construction of Crouch-Grossman methods*, BIT, **41** (2001) 207–214.
18. Jackiewicz Z., Marthinsen A., Owren B., *Construction of Runge-Kutta methods of Crouch-Grossman type of high order*, Advances in Computational Mathematics **13** (2000) 405–415.
17. Munthe-Kaas H., Owren B., *Computations in a free Lie algebra.*, R. Soc. Lond. Philos. Trans. Ser. A Math. Phys. Eng. Sci. **357** (1999), 957–981.
16. Owren B., Marthinsen A., *Runge-Kutta Methods Adapted to Manifolds and Based on Rigid Frames*, BIT **39** (1999) 116–142.
15. Owren B., Welfert B.: *The Newton Iteration on Lie Groups*, BIT **40** (2000), 121–145.
14. Jackiewicz Z., Owren B., Welfert B., *Pseudospectra of Waveform Relaxation Operators*, Computers Math. Appl. , **36** (1998) 67–85.
13. Kværnø A., Nørsett S.P., Owren B., *Runge-Kutta Research in Trondheim*, Applied Numerical Mathematics, **22** (1996) 263–279.
12. Marthinsen A., Munthe-Kaas H., Owren B., *Simulation of Ordinary Differential Equations on Manifolds*, Modeling, Identification and Control, **18** (1997) 75–88.
11. Ekeland K., Owren B., Øines E., *Stiffness Detection and Estimation of Dominant Spectra with Explicit Runge-Kutta Methods*, ACM, Transactions of Mathematical Software, **24** (1998) 368–382.
10. Higham D.J., Owren B., *Non-Normality Effects in a Discretized Nonlinear Reaction-Convection-Diffusion Equation*, J. Comput. Phys., **124** (1996), 309–323.
9. Owren B.: *Stability of Runge-Kutta methods used in modular integration*, J. Comput. Appl. Math., **62** (1995) 89–101.
8. Owren B., Simonsen H.H., *Alternative Integration Methods for Problems in Structural Dynamics*, Comput. Meth. in Appl. Mech. and Eng. **122** (1995), pp 1–10
7. Muir P., Owren B., *Order Barriers and Characterizations of Continuous Mono-Implicit Runge-Kutta Schemes*, Math. Comp., **61** (1993) pp 675–679.
6. Landrø M., Zaalberg-Metselaar G., Owren B., Vaage S., *Modelling of water gun signatures*, Geophysics, **58** (1993), 101–109.
5. Owren B., Zennaro M., *Derivation of Efficient Continuous Explicit Runge-Kutta Methods*, SIAM J. Sci. Stat. Comput., **6** (1992), 1488–1501.
4. Owren B., Zennaro M., *Order Barriers for Continuous Explicit Runge-Kutta Methods*, Math. Comp., **56** (1991), 645–661.
3. Owren B., Seip K.: *A uniqueness result related to the stability of explicit Runge-Kutta methods*, BIT **31**, (1991) 373–374.
2. Owren B., Seip K., *Some Stability Results for Explicit Runge-Kutta Methods*, BIT **30** (1990), 700–706.
1. Owren B., Zennaro M., *Continuous Explicit Runge-Kutta Methods*, in Computational Ordinary Differential Equations, edited by Cash and Gladwell, Clarendon Press (1992), 97–105.