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.*

Håkon Marthinsen 27.11.2014 *On symplectic integration in Lie groups and manifolds*

Geir Bogfjellmo 04.09.2015 *Algebraic and Topological Properties of Numerical Integrators.*

Current Ph.D. students: Manuel Amaya Benitez (from October 1, 2012), Torbjørn Ringholm (from Aug 1, 2014)

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 the Executive Committee for Teacher Education at NTNU, 2012–
- Member of Administrative Council of SEFI (European Society for Engineering Education)
- President of the Norwegian Mathematical Council, 2015–
- 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.

CRISP. EU Seventh Framework Programme, IRSES project 2011–2015. NTNU coordinator.

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

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

Selected publications

49. Marthinsen H., Owren B., *Geometric integration of non-autonomous linear Hamiltonian problems*, to appear in Adv Comput Math.

48. Celledoni E., McLachlan R. I., McLaren D., Owren B., Quispel G. R. W., *Integrability Properties of Kahan's Method*, J. Phys. A. **47** (2014)

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.