

# CURRICULUM VITAE

**NAME:** Harald E. Krogstad

**YEAR OF BIRTH:** 1945–09–16

**NATIONALITY:** Norwegian

**POSITIONS:** Professor in mathematics, NTNU/Research Advisor, SINTEF IKT

**DEPARTMENT:** Mathematical Sciences, Faculty of Information Technology, Mathematics and Electrical Engineering

## **EDUCATION:**

- 1969 The Norwegian Institute of Technology (NTH), Applied Physics.
- 1973 Dr.ing. (Ph.D), NTH, Mathematical Analysis.

## **EXPERIENCE**

- 1969 Research Assistant, Dept. of Numerical Analysis, NTH.
- 1973–74 Research Scientist at Institute Mittag–Leffler, Stockholm, Sweden.
- 1974–76 Assistant Professor, Dept. of Mathematics, NTH.
- 1976–79 Research Scientist, Continental Shelf Institute, IKU, Trondheim.
- 1979–85 Senior Research Scientist, IKU, Trondheim.
- 1981–82 Visiting Scholar, Dept. of Meteorology and Physical Oceanography, M.I.T., Boston.
- 1983–95 Associate Professor, Industrial Mathematics, Div. Mathematical Sciences NTH.
- 1985–87 Section manager, Ocean wave research, Oceanographic Centre.
- 1987–88 Senior Research Engineer, OCEANOR A/S.
- 1988–95 Senior Research Scientist, SINTEF Industrial Mathematics.
- 1996– Senior Scientific Advisor, SINTEF IKT.
- 1996– Professor, Dept. of Mathematical Sciences, Norwegian University for Science and Technology (NTNU).
- 1997 Visiting Scientist, Institut français de recherche pour l’exploitation de la mer (IFREMER), France
- 2002 Visiting Scientist, Spring Term, Rosenstiel School of Marine and Atmospheric Science, Univ. of Miami, USA
- 2006 Visiting Scientist, Spring Term, Rosenstiel School of Marine and Atmospheric Science, Univ. of Miami, USA
- 2009 Visiting Scientist, two months, Institut français de recherche pour l’exploitation de la mer (IFREMER), France

## MAIN FIELDS OF COMPETENCE

- Industrial and Applied Mathematics
- Signal Processing
- Ocean Wave Analysis and Statistics
- Ocean applications of Synthetic Aperture Radar

## PROFESSIONAL MEMBERSHIPS

- Norges Tekniske Vitenskapsakademi
- Society for Industrial and Applied Mathematics (SIAM)
- Institute of Electrical and Electronics Eng. (IEEE)

## LIST OF PUBLICATIONS

### Fourier Analysis and Statistics

1. Multipliers on homogeneous Banach spaces, *Ark. f. Matematik*, **12** (1974) pp. 203–212.
2. Comments on a paper of B.L. Gupta, *Per. Math. Hungarica*, **6** (1975) pp. 273–275.
3. On a class of summability methods for Fourier series, *Per. Math. Hungarica*, **7** (1976) pp. 127–135.
4. Multipliers and the Hilbert distribution (with R. Larsen and J.T. Burnham), *Nanta Math.*, **3** (1976) pp. 95–103.
5. Multipliers of Segal algebras, *Math. Scand.*, **38** (1976) pp. 285–303.
6. The  $A(p, q)$  algebras and singular measures with Fourier transforms in  $L(2, q)$ ,  $q > 2$ , *Hokk. Math. Journal*, **7** (1978) pp. 27–42.
7. On the Covariance of the Periodogram, *J. Time Series Analysis*, **3** (1982) pp. 195–207.
8. Simulation of Multivariate Gaussian Time Series, *Comm. in Statistics*, **18**, No. 3 (1989) pp. 929–941.

### Applied Mathematics

1. *Numeriske metoder* (with J. O. Aasen, S.P. Nørsett, D. Andreassen and T. Haavie), Tapir 1975, 151s.
2. Møte med en industriell matematiker (with Anne Randi Syversveen), in *Fra matematikkens spennende verden* (Ed. P. Hag and B. Johnsen), pp. 159–166, Tapir 1993.
3. Mathematical Modelling – a Challenging Course, in *Progress in Industrial Mathematics at ECMI 2000*, Mathematics in Industry, 1 Eds. A. M. Anile, V. Capasso, A. Greco, Springer 2002, pp. 459 – 465.

4. Eigenfunction analysis of stochastic backscatter for characterization of acoustic aberration in medical ultrasound imaging (with T. Varslot, E. Mo and B. Angelsen) *J. Acoustical Soc. of America*, **115**(6) (2004) pp. 3068–3076.
5. Adaptive algorithm for an inverse electromagnetic scattering problem, *Applicable Analysis*, **88**:1 (2009) pp. 15–28 (with L. Beilina and M.P. Hatlo Andresen)
6. Effect of gain saturation in a gain compensated perfect lens (with M.P. Hatlo Andresen, A. V. Skaldebo, M.W. Haakestad, and J. Skaar), *J. Opt. Soc. Am. B* **27**(8) (2010) pp. 1610–1616.
7. Inverse scattering of 2d photonic structures by layer-stripping (with M.P. Hatlo Andresen and J. Skaar), accepted for publication in *J. Opt. Soc. Am.* 2011. arXiv:1102.0474v1.

### Ocean Waves Analysis and Remote Sensing

1. Analysis of Wave Spectra from the Norwegian Continental Shelf (with L.I. Eide, K. Torsethau- gen and S. Tryggstad), Proc. Port and Ocean Engineering under Arctic Conditions '79 (1979) pp. 547–578.
2. Some observations of Ocean Fronts, Waves and Currents in the Surface Along the Norwegian Coast from Satellite Images and Drifting Buoys (with T. Audunson, V. Dalen, H.N. Lie and P. Steinbakke). Proc. Symposium of the Norwegian Coastal Current, Geilo, 1980.
3. Analysis of Wave Directionality from a Heave, Pitch and Roll Buoy Operated Outside Norway (with T. Audunson and S. Barstow), Proc. Workshop for wave directionality, Paris, October 1981.
4. Directional Wave Spectra From Heave/Pitch/Roll Data Buoys (with S.F. Barstow), Proc. Oceans'83, **3** (1983) pp. 292–297, San Francisco.
5. General Interpretation of Directional Ocean Wave Data from Heave/Pitch/Roll Buoys (with S.F. Barstow), *Modelling, Identification and Control*, **5** (1984) pp. 47–70.
6. Height and period distributions of extreme waves, *Appl. Ocean Res.*, **7** (1985) pp. 158–165.
7. Procedures and problems associated with the calibration of wave sensors (with S.F. Barstow, K. Torsethau- gen, T. Audunson), *Adv. Underwater Techn. and Offs. Eng.* **4** (1985) pp. 55–82.
8. Directional wave spectra from aerial and satellite imagery, Proc. 4th Stand. Conf. on Image Analysis, Trondheim, 1985.
9. Maximum entropy estimation of the directional distribution in ocean wave spectra (with A. Lygre), *J. Phys. Ocean.*, **16** (1986) pp. 2052–2060.
10. Maximum likelihood estimation of ocean wave spectra from general arrays of wave gauges, *Mod. Ident. Control*, **9** (1988) pp. 81–97.
11. Some results from LEWEX (with R. B. Olsen and S. P. Kjeldsen), Proc. 21st International Conference on Coastal Engineering, Malaga, Spain, 1988.
12. Long period swell wave events on the Norwegian Shelf (with B. Gjevik, A. Lygre and O. Rygg), *J. Phys. Ocean.*, **18** (1988) pp. 724–737.

13. High-resolution directional wave spectra from horizontally mounted acoustic doppler current meters (with M. Miller and R.L. Gordon), *J. Atmos. Ocean. Techn.*, **5** (1988) pp. 340–352.
14. An intercomparison of SAR and buoy directional wave spectra from LEWEX (with R. B. Olsen), Proc. IGARSS'88 (1988) pp. 147–148.
15. The WADIC Project: A Comprehensive Field Evaluation of Directional Wave Instrumentation (with T. Audunson, S.F. Barstow, S. Bjerken, P. Steinbakke, L. Vartdal, L.E. Borgman, C. Graham and J. Allender), *Ocean Engineering*, **16** (1989) pp. 505–526.
16. Measurement of Wave properties in Extreme Seas During the WADIC experiment (with S.F. Barstow, L. Vartdal), OTC 5964, Houston 1989.
17. Observations of wave kinematics in the WADIC experiment, Proc. E&P Forum on Wave Kinematics and loading, Paris, Oct. 25–26, 1989.
18. Measurements of wave kinematics in the WADIC Project, Proc. NATO Adv. Workshop on Water Wave Kinematics, May, Molde 1989 (1990) pp. 633–640.
19. Measuring Wave Direction using upward-looking Doppler sonar (with A. Lohrmann, L.R. Gordon, E.A. Terray and R. Cabrera), Proc. 4th IEEE Conf. on Current Measurements, April 1990 .
20. On Hasselmann's nonlinear transformation for the velocity bunching in SAR images of ocean waves, First Scandinavian Symp. on Radar Techniques and Applications, DTH, Lyngby, June 1990.
21. Estimation of directional ocean wave spectra, Proc. 1st Scand. Forum for Stochastic Mechanics, Univ. i Lund, August 1990.
22. Reliability and Resolution of Directional Wave Spectra From, Heave, Pitch and Roll Data Buoys, in *Directional Wave Spectra*, Ed. R.C. Beal , Johns Hopkins University Press, 1991.
23. The stochastic model of ocean wind waves, Proc. 5th ECMI Symposium, Ed. M. Heiliö, Taubner 1991.
24. The Wavescan second generation directional wave buoy (with S.F.Barstow, G. Ueland and B.A. Fossum), *IEEE J. of Ocean. Eng.*, **16**, No. 3 (1991) pp. 254–266.
25. On Hasselman's nonlinear Ocean-SAR transformation (with H. Schyberg), Proc. IGARSS'91, Espoo Finland, 1991.
26. A simple derivation of Hasselman's nonlinear ocean-sar transformation, *J. Geophys. Res.*, **97**,C2 (1992) pp. 2421–2425.
27. Inversion of Synthetic Aperture Radar Ocean Image Spectra (with G. Engen and H. Johnsen), Proc. IGARSS'92, Houston, 1992.
28. Directional Wave Spectra by Inversion of ERS-1 SAR Imagery (with G. Engen, S.F. Barstow and H. Johnsen), Proc. ESA ERS-1 Cal/Val Workshop, Penhorst, May 1992
29. The maximum likelihood property of estimators of wave parameters from heave/pitch and roll data buoys (with I. K. Glad), *J. Atmos. and Ocean. Techn.* **9**, No. 2 (1992) pp. 169–173.

30. Analysis Of Extreme Waves And Recent Storms In The Norwegian Sea (with S.F. Barstow), Proc. *Climatic Trends and Future Offshore Design and Operation Criteria Workshop*, Reykjavik, Iceland 29–30 March 1993.
31. Characterization of Wind Fronts in SAR Images (with O. Gråbak and J. A. Johannesen), Proc. IGARSS'93, Tokyo 1993.
32. Azimuth Smearing in Ocean–SAR Image Spectra: A Study of Hasselmann's Closed–Form Transformation Based on Simulations of NORCSEX'88 SAR Data (with K. A. Høgda, S. Jacobsen, and G. Engen), *Radio Science*, **28**, No. 4 (1993), pp. 501–512.
33. Estimation of Directional Spectra by ML/ME–Methods (with Ola Haug), Proc. WAVES'93, New Orleans 25–28 July 1993.
34. Airborne Synthetic Aperture Radar Observations and Simulations for Waves in Ice (with P. Vachon, R.B. Olsen and A.K. Liu), *J. Geophys. Res.*, **98**, No. C9 (1993) pp. 16411–16425.
35. Generalizations of the Nonlinear Ocean–SAR Transformation and a Simplified SAR Inversion Algorithm (with O. Samset and P. W. Vachon), *Atmosphere and Ocean*, **32**, No. 1 (1994) pp. 61–82.
36. Airborne and Spaceborne Synthetic Aperture Radar Observations of Ocean Waves (with P. W. Vachon and J. Scott Paterson), *Atmosphere and Ocean*, **32**, No. 1 (1994) pp. 83–112.
37. Directional Wave Spectra by Inversion of Synthetic Aperture Radar Ocean Imagery (with G. Engen, H. Johnsen, S.F. Barstow), *IEEE Trans. Geoscience and Remote Sensing*, **32**, No.2 (1994) pp. 340 – 352.
38. Calibration and Use of GEOSAT Altimeter Wave Data (with S.F, Barstow), Proc. Second ERS–1 Workshop IFREMER – Centre de Brest, March 1994.
39. Ocean–SAR Inversion with ERS–1 Wave Mode Spectra, Proc. Second ERS–1 Workshop IFREMER – Centre de Brest, March 1994.
40. Processing and Application of Wind Scatterometer Data and SAR Wave Spectra in Numerical Wave and Weather Prediction (with J. Sunde, L.A. Breivik, B. Haugse, H. Johnsen and M. Reistad), Proc. ERS–1 Pilot Project Workshop, Toledo, 22–24 June (1994).
41. The WAVEMOD project: Probabilistic Methods for Coastal Site Investigations (with C.G. Soares and M. Prevosto), Proc. OCEANS 94 OSATES Conference, Brest, France, Vol. 1 (1994) pp. 493–497.
42. World Wave Climatologies from Satellite Altimeters, (with S.F. Barstow, T.I. Bern, T.I. Brate, O. Haug and O.G. Houmb), OCEANS 94, Brest , France, Sept. 1994.
43. Wave Climate Assessment by Satellite Remote Sensing (with S.F. Barstow), Proc. ISOPE–95, The Haag, June 11–16, 1995.
44. Observation of the High Frequency Range of the Wave Spectrum (with M. Provosto, C. Guedes Soares and S.F. Barstow), Proc. OMAE'95, Copenhagen, June 1995.
45. World Wave Atlas: A PC MS–Windows Product for Wave Climate Assessment Globally (with S.F. Barstow and O. Haug), 3rd Them. Conf. Rem. Sens. for Marine and Coast. Env. Seattle, Sept. 1995.

46. Wave–Climate Assessment by Satellite Remote Sensing (with S.F. Barstow ), *Sea Techn. Mag.*, October 1995, pp. 31–38.
47. Synthetic Aperture Radar Imagery of Ocean Waves (with P.W. Vachon) in *Oceanographic Application of Remote Sensing*, ed.: M. Ikeda and F.W. Dobson, CRS Press Inc. 1995, pp. 237–255.
48. Surface Wave and Current Variability Experiments (SCAWVEX) (with L.R. Wyatt, K-W Gurgel, D. Prandle and G.K. Wensink), MAST Days, Sorrento, Nov. 1995.
49. Observation of the High Frequency Range of the Wave Spectrum (with M. Provosto, C. Guedes Soares and S.F. Barstow) *J. OMAE* **118** (1996) pp. 89–95.
50. Synthetic Aperture Radar Observations of Ocean Waves, Proc. HERMIS’96, published in *HERMIS*, **1** (2000) pp. 187–194.
51. Quantitative estimation of upper ocean and air–sea interaction processes using tandem ERS–1/2 SAR and synergetic instrument combinations (with A. D. Jenkins, O. M. Johannessen, E. Korsbakken, P. Samuel, H. A. Espedal, R. A. Flather, D. Prandle, A. Ruiz de Elvira) in *Proc. 3rd ERS symposium, Florence, March 1997*.
52. Assimilation of ERS SAR wave spectra in an operational wave model (with L.-A. Breivik, M. Reistad, H. Schyberg J. Sunde, H. Johnsen) *J. Geophys. Res.*, **103**, No. C4 (1998) pp. 7887–7900.
53. The SCAWVEX project (with L.R. Wyatt, K-W Gurgel, H.C. Peters, D. Prandle, O. Haug, H. Gerritsen, and G.J. Wensink) Proc. WAVES’97, Nov. 3–7 1997, **2**, ASCE (1998) pp. 1457–1468.
54. Satellite Altimeter Data in Wave Energy Studies (with S. F. Barstow, O. Haug) Proc. WAVES’97, Nov. 3–7 1997, **1**, ASCE (1998) pp. 339 –354.
55. Directional Distributions in Wave Spectra (with S. F. Barstow, O. Haug, and D. J. H. Peters) Proc. WAVES’97, Nov. 3–7 1997, **1**, ASCE (1998) pp. 883 – 895.
56. SMART–800: A GPS–based directional Wave Buoy (with S. F. Barstow, O. Haug, and P. Ø. Markussen, G. Ueland, I. Rodriguez), Proc. WAVES’97, Nov. 3–7 1997, **2**, ASCE (1998) pp. 1182 – 1195.
57. Satellite Wave Measurements (with S.F. Barstow) Proc. Oceanology International 98, 10–13 March 1998, Brighton, England, **3** (1998) pp. 445–454.
58. SMART–800: Remotely sensed Directional Spectra from a Moored Buoy (with S.F. Barstow, O. Haug, and P.Ø. Markussen, G. Ueland and I. Rodriguez), Proc. Oceanology International 98, 10–13 March 1998, Brighton, England, **3** (1998) pp. 399 – 408.
59. Directional Characteristics of Wave Spectra, Proc. COST Conference on Provision and Engineering/Operational Applications of Ocean Wave Spectra, Paris 21–25 Sept. 1998.
60. Observed Short– and Long–Term Distributions of Wave Steepness (with M. Olagnon), Proc. 8th International Offshore and Polar Engineering Conference **3** (1998) ISBN 1–880653–37–0.
61. Directional distributions in ocean wave spectra (with S. Barstow), 9<sup>th</sup> International Offshore and Polar Engineering Conference, Brest 1999, **3**, pp. 79–86.

62. Methods for intercomparison of wave measurements (with J. Wolf, S.P Thompson, L. R. Wyatt), *Coastal engineering*, **37**(1999) pp. 235–257.
63. Satellite wave measurements for coastal engineering applications (with S. Barstow), *Coastal engineering*, **37**(1999) pp. 283–307.
64. Some recent developments in wave buoy measurement technology (with S. Barstow, S.E. Aasen, I. Rodriguez), *Coastal engineering*, **37**(1999) pp. 309–329
65. Recent Advances in Wave Measurement Technology (with S. Barstow), 9<sup>th</sup> International Offshore and Polar Engineering Conference, Brest 1999, **3**, pp. 19–26.
66. Probability distributions for maximum wave and crest heights (with M. Prevosto and A. Robin), *Coastal engineering*, **40** (2000) pp. 329 – 360.
67. A unified approach to extreme value analysis of ocean waves (with S. Barstow), Proc. 10 th International Offshore and Polar Engineering Conference, 2000, Seattle USA, **3**, pp. 103–108.
68. The spectral wave climate in Barents Sea (with L. Lopatoukhin, Leonid, V. Rozhkov, A. Boukhanovsky, A. Degtyarev, K. Sas’kov, G. Athanassoulis, C. Stefanakos) , Proc. 21st International Conference on Offshore Mechanics And Arctic Engineering 23–28 June 2002, Oslo.
69. A numerical study of the nonlinear ocean–SAR spectral transform (with S. Fouques), Proc. IGARSS 2003, Toulouse.
70. Evolution of a narrow-band spectrum of random surface gravity waves (with K.B Dysthe, K. Trulsen, J. Liu, H. Socquet–Juglard), *J. of Fluid Mech.*, **478** (2003) pp. 1–10.
71. Stochastic simulation of inhomogeneous metocean fields. Part I: Annual variability (with A. V Boukhanovsky, L. J. Lopatoukhin, V. A. Rozhkov), Proc. ICCS–2003, *Lect. Notes in Comp. Science*, LNCS 2658, Springer–Verlag, **2** (2003) pp. 213–222.
72. Stochastic simulation of inhomogeneous metocean fields. Part II: Synoptic variability and rare events (with A. V Boukhanovsky, L. J. Lopatoukhin, V. A. Rozhkov, G. A. Athanassoulis, C. N. Stephanakos), Proc. ICCS–2003, *Lect. Notes in Comp. Science*, LNCS 2658, Springer–Verlag, **2** (2003) pp. 223–232.
73. Analysis and Applications of Second–Order Models for Maximum Crest Height (with S. Barstow), *J. Offshore Mechanics And Arctic Eng.*, **126** (2004) pp. 66–71.
74. Intercomparison of sea-state and zero-crossing parameters from the WACSYS field experiment and interpretation using video evidence (with S. Barstow, L. Lønseth, J.P. Mathisen, G. Mørk, P. Schjølberg), *J. Offshore Mechanics And Arctic Eng.*, **126** (2004) pp. 35–42
75. Wave Crest Sensor Intercomparison Study: An overview of WACSYS. (with G Forristall, S Barstow, M Prevosto, P Taylor, P Tromans), *J. Offshore Mechanics And Arctic Eng.*, **126** (2004) pp. 6–34.
76. A Second Order Lagrangian Model for Irregular Ocean Waves (with S. Fouques, D. Myrhaug) Proc. Offshore Mechanics and Arctic Engineering 2004, OMAE2004-51334, Vancouver, Canada, 20–25 June, 2004.

77. Spatial Extremes, Shapes of Large Waves, and Lagrangian Models (with H. Socquet-Juglard, K. B. Dysthe, K. Trulsen, S. Fouques, Jingdong Liu,) Proc. ROGUE WAVES 2004, 20–22 October, SeaTechWeek, Brest, France.
78. "Freak" waves and large-scale simulations of surface gravity waves (with H. Socquet-Juglard, K. B. Dysthe, K. Trulsen, Jingdong Liu,) Proc. 'Aha Huliko'a Hawaiian Winter Workshop, Honolulu, Hawaii.
79. *Measuring and Analysing the Directional Spectra of Ocean Waves*, Ed. and contributor with K. Kahma, D. Hauser, S. Lehner, J. A. J. Monbaliu, L. R. Wyatt, EU COST Action 714, ISBN 92-898-0003-8, EUR 2136, 2005, 465 p.
80. Analysis of wave measurements – a second look, Proc. WAVES 2005, Fifth International Symposium on Ocean Wave Measurement and Analysis, 3–7 July, Madrid, Spain.
81. A Second Order Lagrangian Model for Irrotational Irregular Waves (with S. Fouques and D. Myrhaug), Proc. WAVES 2005, Fifth International Symposium on Ocean Wave Measurement and Analysis, 3–7 July, Madrid, Spain.
82. Wave Measurements from a Subsurface Platform (with T. Pedersen and A. Lohrmann), Proc. WAVES 2005, Fifth International Symposium on Ocean Wave Measurement and Analysis, 3–7 July, Madrid, Spain.
83. Influence of a Nonlinear RAR Modulation on the SAR Imaging of Ocean Waves (with S. Fouques) Proc. IGARSS 2005, 25–29 July, Seoul, Korea,
84. The Statistical Distribution of a Nonlinear Ocean Surface (with J. Liu, K. Trulsen, K. B. Dysthe, H. Socquet-Juglard), Proc. Isope 2005, Vol. 3, 422–428.
85. The Statistical Distribution of a Nonlinear Ocean Surface (with J. Liu, K. Trulsen, K. B. Dysthe, H. Socquet-Juglard), *Int. J. Offs. Polar Eng.*, **15(3)** (2005) pp. 168–174.
86. Probability distributions of surface gravity waves during spectral changes (with H. Socquet-Juglard, K. Dysthe, K. Trulsen, J. Liu), *J. Fluid Mech.*, **542** (2005) pp. 195–216.
87. Wavelet and Local Directional Analysis of Ocean Waves (with M. Donelan and A-K Magnusson), Proc. ISOPE 2006, Vol. 3.
88. A Second Order Lagrangian Model for Irregular Ocean Waves (with S. Fouques, D. Myrhaug), *J. Offshore Mech. Arct. Eng.*, **128(3)** pp. 177–183.
89. Wavelet and Local Directional Analysis of Ocean Waves (with M. Donelan and A-K Magnusson), *Int. J. Offs. Polar Eng.*, **16(2)** (2006) pp. 97–103.
90. Oceanic Rogue Waves (with K. Dysthe and P. Müller), *Annual Review in Fluid Mechanics* **40** (2008) pp. 287–310.
91. Extreme Waves in the Long-Term Wave Measurements at Ekofisk (with S.F. Barstow, J. P. Mathisen, L. Lønseth, A. K. Magnusson, M. A. Donelan), Proc. Rogue Waves 2008, Brest, Oct. 13–15 (2008).
92. Rogue Waves (with K. Dysthe and P. Müller), *Encyclopedia of Ocean Sciences, 2nd Edition* (2009) pp. 4363–4373.
93. Interpretations and observations of ocean wave spectra (with K. Trulsen), *Ocean Dynamics* **60(4)** (2010), pp. 973–991.