Publication list

(Most recent item first under each heading.)

Authored Books

1. Ell, T. A., Le Bihan, N. and Sangwine, S. J., *Quaternion Fourier Transforms for Signal and Image Processing*, ISTE-Wiley, ISBN 978-1-84821-478-1, xxii+127pp, May 2014. doi:10.1002/9781118930908.

2. Sangwine, S. J., *Electronic Components and Technology*, (3rd edition), CRC Press, March 2007, ISBN 0-8493-7497-9, xiv+214pp.
—, *Solutions manual for: Electronic Components and Technology (3rd edition)*, Taylor and Francis, New York, 2007, 13pp. ISBN 1-4200-5249-7.
— (2nd edition), (Tutorial Guides in Electronic Engineering, #13), Chapman and Hall, July 1994, ISBN 0-412-55700-2, x + 195pp. Reprinted: 1998, Stanley Thornes (Publishers), ISBN 0-7487-4076-7; 2001, Nelson Thornes Ltd.; ca.2004, CRC Press. doi:10.1007/978-1-4899-6934-7
— First published as: *Electronic Components and Technology – Engineering Applications*, (Tutorial Guides in Electronic Engineering, #13), Van Nostrand Reinhold (UK), 1987, x + 181pp. ISBN 0-278-00017-7. Reprinted: 1988, VNR International; 1991, Chapman and Hall, ISBN 0-412-44210-8.

Edited Books

3. Muhammad Yasir Qadri and Stephen J. Sangwine (eds.) *Multicore Technology: Architecture, Reconfiguration and Modeling*, CRC Press, Boca Raton, FL, xxvi+465 pp, 2013. ISBN 978-1-4398-8063-0 ebook: ISBN 978-1-4398-8064-7. doi:10.1201/b15268

4. Eckhard Hitzer and Stephen J. Sangwine (eds.), *Quaternion and Clifford Fourier Transforms and Wavelets*, Trends in Mathematics, Birkhäuser/Springer Basel, 2013. xxvii+338 pp. ISBN 978-3-0348-0602-2, doi:10.1007/978-3-0348-0603-9.

5. Sangwine, S. J. and Horne, R. E. N. (eds.), *The Colour Image Processing Handbook*, Chapman and Hall, March 1998, ISBN 0-412-80620-7, xvi + 440pp, reprinted by Springer Science+Business Media, ISBN 978-1-4613-7647-7, doi:10.1007/978-1-4615-5779-1.

Book chapters

6. Eckhard Hitzer and Stephen J. Sangwine, 'Embedding the Okubo algebra in Clifford"s geometric algebras and vice versa', Chapter 3, *in* E. Hitzer *et al*. (eds.), *Generalizations of Complex Analysis and Applications*, Trends in Mathematics, Birkhäuser/Springer Basel, 2026. doi:10.1007/978-3-032-09159-8_3

7. Fred Brackx, Eckhard Hitzer and Stephen J. Sangwine, 'History of quaternion and Clifford Fourier transforms and wavelets', pp. xi–xxvii *in:* Hitzer and Sangwine (eds.) *Ibid*., doi:10.1007/978-3-0348-0603-9.

8. Eckhard Hitzer and Stephen J. Sangwine, 'The Orthogonal 2D Planes Split of Quaternions and Steerable Quaternion Fourier Transformations', Chapter 2, pp. 15–39 *in:* Hitzer and Sangwine (eds.) *Ibid*., doi:10.1007/978-3-0348-0603-9_2.

9. Nicolas Le Bihan and Stephen J. Sangwine, 'Quaternionic Spectral Analysis of Non-Stationary Improper Complex Signals', Chapter 3, pp. 41–56 *in:* Hitzer and Sangwine (eds.) *Ibid*., doi:10.1007/978-3-0348-0603-9_3.

10. Sangwine, S. J., Ell, T. A. and Le Bihan, N., 'Hypercomplex models and processing of vector images', *in*: Christophe Collet, Jocelyn Chanussot and Kacem Chehdi (eds.), *Multivariate Image Processing*, Digital

Signal and Image Processing Series, ISTE/Wiley, 2010, Chapter 13, pp 407–436, ISBN 978-1-84821-139-1.

11. Sangwine, S. J. and Thornton, A. L., 'Frequency domain methods', Chapter 12 *in*: Sangwine, S. J. and Horne, R. E. N. (eds.), *Ibid*., 228–241, doi:10.1007/978-1-4615-5779-1_12.

Journal papers

12. Sangwine, S. J. and Hitzer, E., 'Polar Decomposition of Complexified Quaternions and Octonions', *Advances in Applied Clifford Algebras*, **30**, 22 February 2020, doi:10.1007/s00006-020-1048-y.

13. Hitzer, E. and Sangwine, S. J., 'Foundations of Conic Conformal Geometric Algebra and Compact Versors for Rotation, Translation and Scaling', *Advances in Applied Clifford Algebras*, **29**, 4 October 2019, doi:10.1007/s00006-019-1016-6.

14. Hitzer, E. and Sangwine, S. J., 'Construction of multivector inverse for Clifford algebras over $2m+1$-dimensional vector spaces from multivector inverse for Clifford algebras over $2m$-dimensional vector spaces', *Advances in Applied Clifford Algebras*, **29**, 19 February 2019, doi:10.1007/s00006-019-0942-7.

15. Shagufta Yasmin and Stephen J. Sangwine, 'Multi-directional colour edge detector using linear quaternion system convolution', *IET Image Processing*, **12**, (7), 1111–1116, 2018. doi:10.1049/iet-ipr.2017.0921.

16. Hitzer, E. and Sangwine, S. J., 'Multivector and multivector matrix inverses in real Clifford algebras', *Applied Mathematics and Computation*, **311**, 15 October 2017, 375-389. doi:10.1016/j.amc.2017.05.027.

17. Fletcher, P. and Sangwine, S. J., 'The development of the quaternion wavelet transform', *Signal Processing*, **136**, July 2017, 2–15. doi:10.1016/j.sigpro.2016.12.025.

18. Sangwine, S. J. and Hitzer, E., 'Clifford Multivector Toolbox (for MATLAB)', *Advances in Applied Clifford Algebras*, **27**, (1), March 2017, 539-558. doi:10.1007/s00006-016-0666-x.

19. Sangwine, S. J., 'On harmonic analysis of vector-valued signals', *Mathematical Methods in the Applied Sciences*, **40**, (1), 15 January 2017, 22–30, doi:10.1002/mma.3938.

20. De Bie, H. and De Schepper, N. and Ell, T. A. and Rubrecht, K. and Sangwine, S. J., 'Connecting spatial and frequency domains for the quaternion Fourier transform' *Applied Mathematics and Computation*, **271**, 581-593, 15 November 2015, doi:10.1016/j.amc.2015.09.045.

21. Sangwine, S. J., "Comments on 'A structure-preserving method for the quaternion LU decomposition in quaternionic quantum theory' by Minghui Wang and Wenhao Ma", *Computer Physics Communications*, **188**, 128-130, March 2015, doi:10.1016/j.cpc.2014.11.016.

22. Le Bihan, N., Sangwine, S. J. and Ell, T. A., 'Instantaneous Frequency and Amplitude of Orthocomplex Modulated Signals based on Quaternion Fourier Transform', *Signal Processing*, **94**, 308-318, January 2014. doi:10.1016/j.sigpro.2013.06.028.

23. Sangwine, S. J., 'Perspectives on Color Image Processing by Linear Vector Methods using Projective Geometric Transformations', in P. W. Hawkes (ed), *Advances in Imaging and Electron Physics*, **175**, Chapter 6, 283–307, 2013. Academic Press: Elsevier Inc. doi:10.1016/B978-0-12-407670-9.00006-8.

24. Sangwine, S. J. and Ell, T. A., 'Complex and Hypercomplex Discrete Fourier Transforms Based on Matrix Exponential Form of Euler's Formula', *Applied Mathematics and Computation*, **219**, (2), October 2012, 644–655. doi:10.1016/j.amc.2012.06.055. Published online 24 July 2012.

25. Sangwine, S. J. and Ell, T. A. and Le Bihan, N., 'Fundamental representations and algebraic properties of biquaternions or complexified quaternions', *Advances in Applied Clifford Algebras*, **21**, (3), September 2011, 607–636, doi:10.1007/s00006-010-0263-3. Published online 25 November 2010.

26. Sangwine, S. J. and Alfsmann, D., 'Determination of the biquaternion divisors of zero, including the idempotents and nilpotents', *Advances in Applied Clifford Algebras*, **20**, (2), May 2010, 401–410, doi:10.1007/s00006-010-0202-3. Published online 9 January 2010.

27. Sangwine, S. J. and Le Bihan, N., 'Quaternion polar representation with a complex modulus and complex argument inspired by the Cayley-Dickson form', *Advances in Applied Clifford Algebras*, **20**, (1), March 2010, 111-120, doi:10.1007/s00006-008-0128-1. Published online 22 August 2008.

28. Said, S., Le Bihan, N. and Sangwine, S. J., 'Fast complexified quaternion Fourier transform', *IEEE Transactions on Signal Processing*, **56**, (4), April 2008, 1522–1531, doi:10.1109/TSP.2007.910477.

29. Le Bihan, N. and Sangwine, S. J., 'Jacobi Method for Quaternion Matrix Singular Value Decomposition', *Applied Mathematics and Computation*, **187**, (2), 15 April 2007, 1265–1271, doi:10.1016/j.amc.2006.09.055.

30. Ell, T. A. and Sangwine, S. J., 'Quaternion Involutions and Anti-Involutions', *Computers and Mathematics with Applications*, **53**, (1), January 2007, 137–143. doi:10.1016/j.camwa.2006.10.029.

31. Ell, T. A. and Sangwine, S. J., 'Hypercomplex Fourier Transforms of Color Images', *IEEE Transactions on Image Processing*, **16**, (1), January 2007, 22–35, doi:10.1109/TIP.2006.884955.

32. Sangwine, S. J. and Le Bihan, N., 'Quaternion singular value decomposition based on bidiagonalization to a real or complex matrix using quaternion Householder transformations', *Applied Mathematics and Computation*, **182**, (1), 1 November 2006, 727–738, doi:10.1016/j.amc.2006.04.032.

33. Sangwine, S. J., 'Biquaternion (Complexified Quaternion) Roots of -1', *Advances in Applied Clifford Algebras*, **16**, (1), February 2006, 63–68. doi:10.1007/s00006-006-0005-8.

34. Moxey, C. E., Sangwine, S. J. and Ell, T. A., 'Hypercomplex Correlation Techniques for Vector Images', *IEEE Transactions on Signal Processing*, **51**, (7), July 2003, 1941-1953. doi:10.1109/TSP.2003.812734.

35. Sangwine, S. J., Ell, T. A. and Moxey, C. E., 'Vector Phase Correlation', *Electronics Letters*, **37**, (25), December 6 2001, 1513-5. doi:10.1049/el:20011035.

36. Sangwine, S. J., 'Colour in Image Processing', *Electronics & Communication Engineering Journal*, **12**, (5), October 2000, 211-219. doi:10.1049/ecej:20000503.

37. Sangwine, S. J. and Ell, T. A., 'Colour image filters based on hypercomplex convolution', *IEE Proceedings – Vision, Image and Signal Processing*, **147**, (2), April 2000, 89-93. doi:10.1049/ip-vis:20000211.

38. Sangwine, S. J., 'Colour image edge detector based on quaternion convolution', *Electronics Letters*, **34**, (10), May 14 1998, 969-971. doi:10.1049/el:19980697.

39. Sangwine, S. J., 'Fourier transforms of colour images: the quaternion FFT', *Image Processing & Communications*, **4**, (1–2), 1998, 3–8.

40. Berriss, W. P. and Sangwine, S. J., 'Automatic Quantitative Analysis of Healing Skin Wounds using Colour Digital Image Processing', *World Wide Wounds*, (online journal), September 1997, available at: http://www.worldwidewounds.com/1997/july/Berris/Berris.html.

41. Sangwine, S. J., 'Fourier transforms of colour images using quaternion, or hypercomplex, numbers', *Electronics Letters*, **32**, (21), October 10 1996, 1979–80. doi:10.1049/el:19961331.

42. Sangwine, S. J., 'Experiences with high-level design and modelling of digital systems', *Int. J. Electrical Engineering Education*, **32**, (4), October 1995, 333–340. doi:10.1177/002072099503200408.

43. Sangwine, S. J., 'A Digital-Signal Processing laboratory based on the TMS320C25', *Int. J. Electrical Engineering Education*, **32**, (1), January 1995, 21–30. doi:10.1177/002072099503200103.

44. Pritchard, A. J., Sangwine, S. J. and Horne, R. E. N., 'Rational arithmetic representation of colour image pixels', *Electronics Letters*, **30**, (18), 1 September 1994, 1474–1475. doi:10.1049/el:19941008.

45. Sangwine, S. J., 'Diagnosis of multiple faults in combinational digital circuits by modelling of transition propagation along critical paths', *IEE Proceedings*, **139**, Part G, (5), October 1992, 594–606. doi:10.1049/ip-g-2.1992.0092.

46. Sangwine, S. J., 'Deductive fault diagnosis in digital circuits: a survey', *IEE Proceedings*, **136**, Part E, (6), November 1989, 496–504. doi:10.1049/ip-e.1989.0068.

47. Sangwine, S. J., 'Fault diagnosis in combinational digital circuits using a backtrack algorithm to generate fault location hypotheses', *IEE Proceedings*, **135**, Part G, (6), December 1988, 247–252. doi:10.1049/ip-g-1.1988.0035.

Preprints

Those marked with * have been published in journals or as book chapters and appear in the lists above.

48. Sangwine, S. J., Ell, T. A. and William O. R. d. L. Yates, 'Phase Content of Signals and Images with Vector-Valued Samples or Pixels', 10 January 2026. Zenodo. doi:10.5281/zenodo.18209257.

49. Sangwine, S. J., 'A Compendium of Classical Quaternion and Octonion Formulae', working paper, 25 November 2025. Zenodo. doi:10.5281/zenodo.17714396.

50. * Hitzer, E. and Sangwine, S. J., 'Foundations of Conic Conformal Geometric Algebra and Simplified Versors for Rotation, Translation and Scaling', e-print http://vixra.org/abs/1905.0030, 2 May 2019.

51. * Sangwine, S. J. and Hitzer, E., 'Polar decomposition of complexified quaternions and octonions', Technical Report CES-535, 10 April 2019, http://repository.essex.ac.uk/24443/.

52. * Hitzer, E. and Sangwine, S. J., 'Construction of multivector inverse for Clifford algebras over $2m+1$-dimensional vector spaces from multivector inverse for Clifford algebras over $2m$-dimensional vector spaces', e-print http://vixra.org/abs/1901.0246, 16 January 2019.

53. * Hitzer, E. and Sangwine, S. J., 'Multivector and multivector matrix inverses in real Clifford algebras', Technical Report CES-534, 21 July 2016, http://repository.essex.ac.uk/17282/.

54. Sangwine, S. J., 'Octonion associators', e-print http://arxiv.org/abs/1509.07718, 25 September 2015.

55. * De Bie, H. and De Schepper, N. and Ell, T. A. and Rubrecht, K. and Sangwine, S. J., 'Connecting spatial and frequency domains for the quaternion Fourier transform' e-print http://arXiv.org/abs/1506.07033, 23 June 2015.

56. * Sangwine, S. J., 'On harmonic analysis of vector-valued signals', e-print http://arxiv.org/abs/1404.2492, 9 April 2014 (v1), 10 August 2015 (v2).

57. * Eckhard Hitzer and Sangwine, S. J., 'The Orthogonal 2D Planes Split of Quaternions and Steerable Quaternion Fourier Transformations', e-print http://arxiv.org/abs/1306.2157, 10 June 2013.

58. * Le Bihan, N. and Sangwine, S. J. and Ell, T. A., 'Instantaneous frequency and amplitude of complex signals based on quaternion Fourier transform', e-print http://arxiv.org/abs/1208.1363, 7 August 2012.

59. Le Bihan, N. and Sangwine, S. J., 'The hyperanalytic signal', e-print http://arxiv.org/abs/1006.4751, 24 June 2010.

60. * Sangwine, S. J. and Ell, T. A., 'Complex and Hypercomplex Discrete Fourier Transforms Based on Matrix Exponential Form of Euler's Formula', e-print http://arxiv.org/abs/arxiv:1001.4379, 25 January 2010 (v1), 9 July 2010 (v2) and 5 July 2011 (v3).

61. * Sangwine, S. J. and Ell, T. A. and Le Bihan, N., 'Fundamental representations and algebraic properties of biquaternions or complexified quaternions', e-print http://arxiv.org/abs/arxiv:1001.0240, 1 January 2010.

62. * Sangwine, S. J. and Alfsmann, D., 'Determination of the biquaternion divisors of zero, including the idempotents and nilpotents', e-print http://arxiv.org/abs/arxiv:0812.1102, 8 December 2008.

63. * Sangwine, S. J. and Le Bihan, N., 'Quaternion polar representation with a complex modulus and complex argument inspired by the Cayley-Dickson form', e-print `arXiv:0802.0852`, 6 February 2008, available at http://arxiv.org/abs/arXiv:0802.0852.

64. Sangwine, S. J., 'Canonic form of linear quaternion functions', e-print `arXiv:0801.2887`, 18 January 2008, available at http://arxiv.org/abs/arXiv:0801.2887.

65. * Said, S., Le Bihan, N. and Sangwine, S. J.,
'Fast complexified quaternion Fourier transform', e-print http://arxiv.org/abs/math.NA/0603578, 24 March 2006.

66. * Sangwine, S. J. and Le Bihan, N., 'Quaternion Singular Value Decomposition based on Bidiagonalization to a Real Matrix using Quaternion Householder Transformations', e-print http://arxiv.org/abs/math.NA/0603251, 10 March 2006.

67. * Sangwine, S. J., 'Biquaternion (complexified quaternion) roots of -1', e-print http://arxiv.org/abs/math.RA/0506190, 10 June 2005.

68. * Ell, T. A. and Sangwine, S. J., 'Quaternion Involutions', e-print http://arxiv.org/abs/math.RA/0506034, 2 June 2005.

Software

69. Sangwine, S. J. and Hitzer, E., 'Clifford Multivector Toolbox (a toolbox for computing with Clifford algebras in Matlab®)', 2015–2024. Version 2 released November 2022 with support for Conformal Geometric Algebras.
Available: https://clifford-multivector-toolbox.sourceforge.io/

70. Ell, T. A. and Sangwine, S. J., 'Linear Quaternion Systems Toolbox for Matlab®', 2007–2022. Available: http://lqstfm.sourceforge.net/

71. Sangwine, S. J. and Le Bihan, N., 'Quaternion Toolbox for Matlab®', 2005–2024. Version 2 released April 2013 with support for octonions. Version 3 released July 2020 with support for symbolic computation.
Available: https://qtfm.sourceforge.io/

72. Sangwine, S. J., 'PNG_IO – An Ada 2012 package for input/output of Portable Network Graphics files', 1999 – 2022. Available: https://png-io.sourceforge.io/ (Originally an Ada 95 package up to release 4.6.)

73. Sangwine, S. J., 'FFTW_Ada – An Ada 2012 binding to the FFTW Fast Fourier Transform library', 2000 – 2024. (Originally an Ada 95 binding.) Available: https://fftwada.sourceforge.io/

Conference papers

Those marked with † have also been published in book form and appear in the list above.

74. Shagufta Yasmin and Stephen J. Sangwine, 'Quaternion Linear Color Edge-Glowing Filter Using Genetic Algorithm', *in* Jacques Blanc-Talon, Cosimo Distante, Wilfried Philips, Dan Popescu and Paul Scheunders (eds), Proceedings, 17th International Conference, Advanced Concepts for Intelligent Vision Systems, (ACIVS), Lecce, Italy, October 24–27, 2016, pp. 616–625. doi:10.1007/978-3-319-48680-2_54. Lecture Notes in Computer Science, LNCS 10016. Springer 2016.

75. Shagufta Yasmin and Stephen J. Sangwine, 'Quaternion Linear Colour Edge-Sharpening Filter using Genetic Algorithm', 8th Computer Science and Electronic Engineering Conference (CEEC), University of Essex, UK, September 2016, pp. 124–129. doi:10.1109/CEEC.2016.7835900.

76. † Hitzer, E. and Sangwine, S. J., 'The orthogonal planes split of quaternions', 9th International Conference on Clifford Algebras and their Applications in Mathematical Physics, K. Gürlebeck (ed.), Weimar, Germany, 15–20 July 2011.

77. † Le Bihan, N. and Sangwine, S. J., 'Quaternionic spectral analysis of non-stationary improper complex signals', *Ibid.*

78. Said, S., Le Bihan, N. and Sangwine, S. J., 'A stability approach to the analysis of rotation time series', 15th IFAC Symposium on System Identification, SYSID 2009, Saint-Malo, France, 6–8 July 2009.

79. Le Bihan, N. and Sangwine, S. J., 'About the extension of the 1D analytic signal to improper complex valued signals', Eighth International Conference on Mathematics in Signal Processing, p 45, 16–18 December 2008, The Royal Agricultural College, Cirencester, UK.

80. Ell, T. A. and Sangwine, S. J., 'Projective-Space Colour Filters using Quaternion Algebra', 16th European Conference on Signal Processing (Eusipco), Lausanne, Switzerland, 25–29 August 2008, EURASIP 2008. doi:10.5281/zenodo.41057.

81. Ell, T. A. and Sangwine, S. J., 'Theory of vector filters based on linear quaternion functions', *Ibid.* doi:10.5281/zenodo.41058.

82. Le Bihan, N. and Sangwine, S. J., 'The H-analytic signal', *Ibid.* doi:10.5281/zenodo.40330

83. Sangwine, S. J. and Le Bihan, N., 'Hypercomplex analytic signals: Extension of the analytic signal concept to complex signals', Eusipco 2007, Poznan, Poland, 3–7 September 2007, 621–4. doi:10.5281/zenodo.40330.

84. Alfsmann, D., Göckler, H., Sangwine, S. J. and Ell, T. A., 'Hypercomplex Algebras in Digital Signal Processing: Benefits and Drawbacks', *Ibid.*, 1322–6. doi:10.5281/zenodo.40473.

85. Said, S., Courty, N., Le Bihan, N., and Sangwine, S. J., 'Exact Principal Geodesic Analysis for Data on SO(3)', *Ibid.* 1701–5. doi:10.5281/zenodo.40550.

86. Sangwine, S. J. and Le Bihan, N., 'Computing the SVD of a quaternion matrix', Seventh International

Conference on Mathematics in Signal Processing, 17–20 December 2006, The Royal Agricultural College, Cirencester, UK, 5–8.

87. Maria Carmen Serrano Gotarredona, Begoña Acha Piñero and Sangwine, S. J., 'Colorimetric calibration of images of human skin captured under hospital conditions', AIC Colour '05, 10th Congress of the International Colour Association, Granada, Spain, 8–13 May 2005, 773-776.

88. Sangwine, S. J. and Ell, T. A. and Gatsheni, B. N., 'Colour-dependent linear vector image filtering', EUSIPCO 2004, Twelfth European Signal Processing Conference, 6–10 September 2004, Vienna, Austria, **I**, 585–588. doi:10.5281/zenodo.38202.

89. Sangwine, S. J. and Ell, T. A., 'Gray-centered RGB Color Space', Second European Conference on Color in Graphics, Imaging and Vision (CGIV 2004), Technology Center AGIT, Aachen, Germany, 5–8 April 2004, The Society for Imaging Science and Technology, 183–6.
doi:10.2352/CGIV.2004.2.1.art00038.

90. Le Bihan, N. and Sangwine, S. J., 'Quaternion principal component analysis for color images', IEEE International Conference on Image Processing (ICIP 2003), Barcelona, Spain, 14–17 September 2003, **1**, 809–812. doi:10.1109/ICIP.2003.1247085

91. Sangwine, S. J. and Gatsheni, B. N. and Ell, T. A., 'Vector amplification for color-dependent image filtering', *Ibid*., **2**, 129–132. doi:10.1109/ICIP.2003.1246633

92. Le Bihan, N. and Sangwine, S. J., 'Analyse de signaux vectoriels basée sur le modèle quaternionique', 19e colloque GRETSI sur le traitement du signal et des images, 300–303, Paris, 8–11 September 2003. Available: https://www.gretsi.fr/data/colloque/pdf/2003_001-0146_13543.pdf

93. Le Bihan, N. and Sangwine, S. J., 'Color image decomposition using quaternion singular value decomposition', International Conference on Visual Information Engineering (VIE 2003), University of Surrey, Guildford, UK, 7–9 July 2003, Institution of Electrical Engineers, Conference Publication 495, 113–116. doi:10.1049/cp:20030500

94. Sangwine, S. J. and Ell, T. A., 'Vector zone plates as test patterns for linear vector filters', IEEE International Conference on Image Processing (ICIP 2002), Rochester, NY, USA, 22–25 September 2002, **II**, 361–364. doi:10.1109/ICIP.2002.1039962

95. Moxey, C. E., Sangwine, S. J. and Ell, T. A., 'Color-grayscale image registration using hypercomplex phase-correlation', *Ibid*., **II**, 385–388. doi:10.1109/ICIP.2002.1039968

96. Moxey, C. E., Ell, T. A. and Sangwine, S. J., 'Hypercomplex operators and vector correlation', EUSIPCO 2002, Eleventh European Signal Processing Conference, 3–6 September 2002, Toulouse, France, **III**, 247–250. doi:10.5281/zenodo.54272.

97. Sangwine, S. J., Gatsheni, B. N. and Ell, T. A., 'Linear colour-dependent image filtering based on vector decomposition', *Ibid*., **II**, 274–277. doi:10.5281/zenodo.40330.

98. Moxey, C. E., Ell, T. A. and Sangwine, S. J., 'Vector correlation of color images', First European Conference on Colour in Graphics, Imaging and Vision (CGIV 2002), University of Poitiers, France, 2–5 April 2002, The Society for Imaging Science and Technology, 343–7. doi:10.2352/cgiv.2002.1.1.art00072.

99. Sangwine, S. J. and Ell, T. A., 'Mathematical approaches to linear vector filtering of color images', *Ibid*. 348-351. doi:10.2352/CGIV.2002.1.1.art00073

100. Sangwine, S. J. and Ell, T. A., 'Hypercomplex Fourier Transforms of Color Images', IEEE Interna-

tional Conference on Image Processing (ICIP 2001), Thessaloniki, Greece, October 7–10, 2001, **I**, 137-140. doi:10.1109/ICIP.2001.958972

101. Evans, C.J., Ell, T. A. and Sangwine, S. J., 'Hypercomplex Color-Sensitive Smoothing Filters', IEEE International Conference on Image Processing (ICIP 2000), Vancouver, Canada, September 11-14, 2000, **I**, 541-544. doi:10.1109/ICIP.2000.901015

102. Ell, T. A. and Sangwine, S. J., 'Hypercomplex Wiener-Khintchine Theorem with Application to Color Image Correlation', *Ibid*. **II**, 792-795. doi:10.1109/ICIP.2000.899828

103. Evans, C.J., Sangwine, S. J. and Ell, T. A., 'Colour-Sensitive Edge Detection Using Hypercomplex Filters', *in:* Gabbouj, M. and Kuosmanen (eds), 'Signal Processing X, Theories and Applications', Proceedings of EUSIPCO 2000, Tenth European Signal Processing Conference, Tampere, Finland, 5-8 September 2000, **I**, 107-110.

104. Bardos, A. J. and Sangwine, S. J., 'Virtual Reality Tool for visualising RGB colour space using VRML', *Ibid*. **II**, 909-912

105. Ell, T. A. and Sangwine, S. J., 'Decomposition of 2D Hypercomplex Fourier Transforms into Pairs of Complex Fourier Transforms', *Ibid*. **II**, 1061-1064.

106. Sangwine, S. J. and Ell, T. A., 'The discrete Fourier transform of a colour image', *in* Blackledge, J. M. and Turner, M. J. (eds), 'Image Processing II: Mathematical Methods, Algorithms and Applications', (Proceedings of Second IMA Conference on Image Processing, De Montfort University, Leicester, UK, September 1998), Horwood Publishing for Institute of Mathematics and its Applications, 2000, 430-441. ISBN 1-898563-61-6.

107. Sangwine, S. J. and Ell, T. A., 'Hypercomplex auto- and cross-correlation of color images', IEEE International Conference on Image Processing, (ICIP'99), Kobe, Japan, 24-28 October 1999, **IV**, 319-322. doi:10.1109/ICIP.1999.819603

108. Sangwine, S. J., 'The problem of defining the Fourier transform of a colour image', IEEE International Conference on Image Processing, (ICIP'98), Chicago, USA, October 4-7 1998, **I**, 171-175. doi:10.1109/ICIP.1998.723451

109. Berriss, W. P. and Sangwine, S. J., 'Automatic 3D histogram clustering to segment and measure images of healing leg ulcers', Medical Image Understanding and Analysis 1998 (MIUA'98), University of Leeds, UK, 6-7 July 1998, 149-152.

110. Sangwine, S. J., 'The discrete quaternion Fourier transform', *Proceedings 6th Int. Conf. on Image Processing and its Applications*, Trinity College, Dublin, Eire, 14-17 July 1997, London, Institution of Electrical Engineers, 1997, 790-793. doi:10.1049/cp:19971004

111. Thornton, A. L. and Sangwine, S. J., 'Log-Polar sampling incorporating a novel spatially-variant filter to improve object recognition', *Ibid*. 776-779. doi:10.1049/cp:19971001

112. Bardos, A. J. and Sangwine, S. J., 'Selective vector median filtering of colour images', *Ibid*. 708-711. doi:10.1049/cp:19970987

113. Berriss, W. P. and Sangwine, S. J., 'A colour histogram clustering technique for tissue analysis of healing skin wounds', *Ibid*. 693-697. doi:10.1049/cp:19970984

114. Bardos, A. J. and Sangwine, S. J., 'Recursive vector median filtering of colour images', In: Domanski, M. and Stasinski, R. (*eds*), *Proceedings 4th Int. Workshop on Systems, Signals and Image Processing*,

Poznan, Poland, 28-30 May 1997, 187-190.

115. Sangwine, S. J., 'Fourier transforms of colour images: the quaternion FFT', *Ibid*., 207-210.

116. Thornton, A. L. and Sangwine, S. J., 'Colour object recognition using phase correlation of log-polar transformed Fourier spectra', *Proceedings 3rd Int. Workshop on Image and Signal Processing*, UMIST, Manchester, UK, 4-7 November 1996, Elsevier Science B.V., Amsterdam, 615-18.

117. Sangwine, S. J. and Bardos, A. J., 'Efficient computation of the 2-dimensional RGB vector median filter', *Ibid*., 317-20.

118. Pritchard, A. J., Horne, R. E. N., Sangwine, S. J., 'Achieving brightness-insensitive measurements of colour saturation for use in colour object recognition', *5th Int. Conf. on Image Processing and its Applications*, Heriot-Watt University, Edinburgh, UK, 3-6 July 1995, London, Institution of Electrical Engineers, 1995, 791-795. doi:10.1049/cp:19950768

119. Thornton, A. L. and Sangwine, S. J., 'Colour object location using complex coding in the frequency domain' *Ibid*., 820-824. doi:10.1049/cp:19950774

120. Sangwine, S. J. and Riach D. A., 'Colour image thresholding at pixel rate using rational arithmetic hardware' *Ibid*., 828-832. doi:10.1049/cp:19950776

121. Miles, J. R. and Sangwine, S. J., 'Six years' experience with IC design teaching at the University of Reading', *Proceedings Workshop on Design Methodologies for Microelectronics and Signal Processing*, Gliwice-Cracow, Poland, October 20-23 1993, 41-45, Department of Automatic Control, Electronics and Computer Science, Silesian Technical University, Gliwice, Poland, 1993.

122. Sangwine, S. J., 'Parallel simulation using an Ada-based event driven simulator kernel', *Ibid*., 221-225.

Colloquium papers

123. Cotton, J. P. and Sangwine, S. J. 'Network-on-a-Chip: a Bisynchronous Channel', IEE/ACM Postgraduate Seminar on SoC Design, Test and Technology, Loughborough University, UK, 15th September 2004, London, Institution of Electrical Engineers, 2004. ISBN 0-86341-460-5, ISSN 0537-9989

124. Bardos, A. J. and Sangwine, S. J., 'Measuring noise in colour images', Electronics and Communications Division Colloquium on Non-Linear Signal and Image Processing, 22 May 1998, 8/1-8/4, Reference #1998/284, London, Institution of Electrical Engineers, 1998. doi:10.1049/ic:19980443

125. Sangwine, S. J., 'Why hands-on and why real signals?', Electronics Division Colloquium on The Teaching of DSP in Universities, February 16 1995, 1/1-1/4, Digest #1995/035, London, Institution of Electrical Engineers, 1995. doi:10.1049/ic:19950205

126. Sangwine, S. J. and Whitehouse, J. E. W, 'The Sampling Theorem - a tutorial', Electronics Division Colloquium on Mathematical Aspects of Digital Signal Processing, University of Bristol, February 10 1994, 1/1-1/6, Digest #1994/034, London, Institution of Electrical Engineers, 1994.

127. Pritchard, A. J., Sangwine, S. J. and Horne, R. E. N., 'Area-thresholding and silhouette extraction of simple coloured objects using hue', Electronics Division Colloquium on Morphological and Non-linear Image Processing Techniques, Savoy Place, London, June 10 1993, 3/1-3/4, Digest #1993/145, London, Institution of Electrical Engineers, 1993.

128. Pritchard, A. J., Sangwine, S. J. and Horne, R. E. N., 'Corner and curve detection along a boundary using line segment triangles', Electronics Division Colloquium on Hough Transforms, Savoy Place, London,

May 7 1993, P2/1-4, Digest #1993/106, London, Institution of Electrical Engineers, 1993.

129. Sangwine, S. J., 'A DSP teaching system using the Texas Instruments TMS320C25', Electronics Division Colloquium on Practical Applications of DSP Devices, Savoy Place, London, June 11 1990, 5/1-5/3, Digest #1990/100, London, Institution of Electrical Engineers, 1990.

Other publications

130. Sangwine, S. J., Deductive diagnosis of multiple faults in combinational digital electronic circuits by analysis of critical paths, PhD Thesis R5964, Department of Engineering, University of Reading, April 1991, 251pp. British Library DSC/SFX 290946.ds

131. Sangwine, S. J., 'A personal alpha-in-air alarm monitoring instrument', AERE–R 10656, Instrumentation and Applied Physics Division, AERE Harwell, Oxfordshire, April 1984. HMSO London. ISBN 0-7058-0938-2. 15pp.

132. Sangwine, S. J., 'Semi-automated testing of proportional counters', AERE–R 9871, Instrumentation and Applied Physics Division, AERE Harwell, Oxfordshire, October 1980. HMSO London. ISBN 0-70-580523-9. 14pp. Available at: http://cds.cern.ch/record/127480/files/CM-P00066965.pdf

133. R. C. Asher, L. Bradshaw, D. Davies, J. E. Perry, S. J. Sangwine and G. J. Vaughan, 'The Injection of Liquid Sodium into Stainless Steel: A report of further experiments Na SS/4, Na SS/5 and Na SS/6' *in*: R. B. Tattersall (ed), *Fourth CSNI Specialist Meeting on Fuel-Coolant Interaction in Nuclear Reactor Safety*, Bournemouth, UK, 2-5 April 1979. CSNI Report No. 37, **1**, paper FCI/P13, 269–306. Committee on the Safety of Nuclear Installations, OECD Nuclear Energy Agency. Paris, France. Produced and printed on behalf of OECD/NEA by AEE Winfrith, October 1979.

134. M. J. Abbey, R. C. Asher, L. Bradshaw, D. Davies and S. J. Sangwine, 'The Injection of Sodium into Liquid Stainless Steel: A Report of the Second Experiment Na-SS/1', *Proceedings of the Third Specialist Meeting on Sodium/Fuel Interaction in Fast Reactors*, Tokyo (Japan); 22-26 March 1976. NEA-CSNI-R–1976-8; AERE–M 2771; Organisation for Economic Co-Operation and Development - Nuclear Energy Agency, Committee on the Safety of Nuclear Installations - OECD/NEA/CSNI, France; 981p; Paper SNI 6/32, pp.366-383, 1976. Available at:
http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/41/049/41049739.pdf.

Dr Stephen J. Sangwine
(Senior Lecturer retired since April 2021)
Formerly with: School of Computer Science and Electronic Engineering,
University of Essex,
Wivenhoe Park,
Colchester CO4 3SQ,
United Kingdom
https://stephen.fourdimensions.blog/
Email: Use my first and last names
as they appear at the top of
my personal web page without
a space, followed by at gmail dotcom.

Google Scholar: https://scholar.google.co.uk/
ORCID: 0000-0002-4569-5630
SCOPUS: 7003346836