

Antonio Palacios

Professor, Applied Mathematics
and Computational Science and
Engineering

Mathematics Department
Computational Science and Engineering Center
San Diego State University
5500 Campanile Drive
San Diego, CA 92182-7720
☎ mobile (858) 449-2721
☎ phone (619) 594-6808
☎ fax (619) 594-6746
✉ email palacios@euler.sdsu.edu
🏠 homepage <http://www.rohan.sdsu.edu/~antonio>

Publications

Books

- [1] V. In and A. Palacios. *Symmetry in Complex Systems: A Unifying Approach to Developing Novel Sensor Devices*. In Preparation for Springer-Verlag, New York, 2016.

Edited Books

- [2] V. In, P. Longhini, and A. Palacios. *Applications of Nonlinear Dynamics*. Springer-Verlag, San Diego, California, 2009.
- [3] V. In, P. Longhini, and A. Palacios. *2nd International Conference on Applications in Nonlinear Dynamics*. AIP Conference Proceedings, Lake Louis, CANADA, 2010.
- [4] V. In, P. Longhini, and A. Palacios. *International Conference on Theory and Applications in Nonlinear Dynamics*. Springer-Verlag, Seattle, Washington, 2013.

Patents

- [5] Multi-frequency synthesis using symmetry methods in arrays of coupled nonlinear oscillators. U.S. Patent # 7196590, 2007.
- [6] Coupled nonlinear sensor system. U.S. Patent # 7420366, 2008.
- [7] Coupled nonlinear sensor system for sensing a time-dependent target signal and method of assembling the system. U.S. Patent # 7528606, 2009.
- [8] Coupled electric field sensors for dc target electric field detection. U.S. Patent # 8049486, 2011.
- [9] Coupled fluxgate magnetometers for dc and time-dependent (ac) target magnetic field detection. U.S. Patent # 7898250, 2011.
- [10] Coupled bistable circuit for ultra-sensitive electric field sensing utilizing differential transistors pairs. U.S. Patent # 8212569, 2012.
- [11] Coupled bistable microcircuit for ultra-sensitive electric and magnetic field sensing. U.S. Patent # 8049570, 2012.
- [12] Enhanced performance in coupled gyroscopes and elimination of biasing signal in a drive-free gyroscope. Navy Case 101427, 2014.
- [13] 2d arrays of diamond shaped cells having multiple josephson junctions. Navy Case 102297, 2015.

- [14] Arrays of superconducting quantum interference devices with self adjusting transfer to convert electromagnetic radiation into a proportionate electrical signal to avoid saturation. Navy Case 101950, 2015.
- [15] Linear voltage response of non-uniform arrays of bi-squids. U.S. Patent # 9097751, 2015.
- [16] Sensor signal processing using cascade coupled oscillators. U.S. Patent # 8994461, 2015.

Manuscripts

- [17] S. Baglio, B. Ando, S. Malfa, V. Marletta, C. Trigona, A. Bulsara, P. Longhini, A. Kho, V. In, J. Neff, G. Anderson, C. Opra, N. Liu, B. Meadows, and A. Palacios. Exploiting nonlinear dynamics in novel measurement strategies and devices: From theoretical models to experiments and applications. *IEEE Transactions on Instrumentation and Measurement*, 60(3):667–695, 2011.
- [18] K. Beauvais, A. Palacios, R. Shaffer, J. Turtle, V. In, and P. Longhini. Coupled spin-torque nano oscillators: Stability of synchronization. In I. Kotsireas, R. Melnik, and B. West, editors, *Advances in Mathematical and Computational Methods: Addressing Modern Challenges of Science, Technology and Society*, volume In print, Melville, New York, 2014. American Institute of Physics.
- [19] S. Berggren, P. Longhini, A. Palacios A.L. de Escobar, O. Mukhanov, and G. Prokopenko. Modeling the effects of fabrication spreads and noise on series coupled arrays of bi-squids. *IEEE Transactions on Applied Superconductivity*, Submitted 2013.
- [20] S. Berggren and A. Palacios. Analytical approximation to the dynamics of an array of coupled dc squids. *The European Physical Journal B*, 87:83, April 2014.
- [21] S. Berggren, G. Prokopenko, P. Longhini, A. Palacios, O. Mukhanov, A.L. de Escobar, B. Taylor, M.C. de Andrade, M. Nisenoff, and R.L. Fagaly. Development of 2d bi-squid arrays with high linearity. *IEEE Transactions on Applied Superconductivity*, 23(3):1400208–1400208, 2013.
- [22] P. Blomgren, S. Gasner, and A. Palacios. Hopping behavior in the kuramoto-sivashinsky equation. *Chaos*, 15:013706, 2005.
- [23] P. Blomgren, S. Gasner, and A. Palacios. Stable second-order scheme for integrating the kuramoto-sivashinsky equation in polar coordinates. *Physical Review E*, 72(3):036701, 2005.
- [24] P. Blomgren, S. Gasner, and A. Palacios. Noise-induced intermittent cellular patterns on circular domains. *International Journal of Bifurcation and Chaos*, 17(8):1–15, 2007.
- [25] P. Blomgren, J.M. Martinez, and A. Palacios. Intermittency near a co-dimension three steady-state bifurcation. *International Journal of Bifurcation and Chaos*, 21(1):287–304, 2011.
- [26] P. Blomgren, A. Palacios, and S. Gasner. Recent advances in 2+1 dimensional simulations of the pattern-forming kuramoto-sivashinsky equation. *Mathematics and Computers in Simulations*, 79(6):1810–1823, 2009.
- [27] P. Blomgren, A. Palacios, B. Zhu, S. Daw, C. Finney, J. Halow, and S. Pannala. Bifurcation analysis of bubble dynamics in fluidized beds. *Chaos*, 17:013120, 2007.
- [28] A. Bulsara, V. In, A. Kho, G. Anderson, C. Opra, P. Longhini, J. Neff, S. Baglio, B. Ando, and A. Palacios. Time domain quantification of the performance of a nonlinear dynamic device in the presence of a noise floor. *Eur. Phys. J. B*, 69:109–118, 2009.
- [29] A. Bulsara, V. In, A. Kho, P. Longhini, A. Palacios, W. Rappel, J. Acebron, S. Baglio, and B. Ando. Emergent oscillations in unidirectionally coupled overdamped bistable systems. *Physical Review E*, 70:036103, 2004.
- [30] A. Bulsara, V. In, A. Kho, A. Palacios, P. Longhini, S. Baglio, and B. Ando. Exploiting nonlinear dynamics in a coupled core fluxgate magnetometer. *Measurement Science and Technology*, 19:075203, 2008.

- [31] A. Bulsara, J. Lindner, V In, A. Kho, S. Baglio, V. sacco, B. Ando, P. Longhini, A. Palacios, and W. Rappel. Coupling-induced cooperative behavior in dynamic ferromagnetic cores in the presence of a noise floor. *Physics Letters A*, 353:4–10, 2006.
- [32] P.-L. Buono, M. Golubitsky, and A. Palacios. Heteroclinic cycles in mode interactions with dn symmetry. In Z. Chen, S-N. Chow, and K. Li, editors, *Bifurcation Theory and Its Numerical Analysis: 2nd International Conference, Xi'an*, pages 13–27, 1998.
- [33] P.-L. Buono, M. Golubitsky, and A. Palacios. Heteroclinic cycles in rings of coupled cells. *Physica D*, 143:74–108, 2000.
- [34] P.L. Buono, B. Chan, A. Palacios, and V. In. Dn-symmetric hamiltonian system: A network of coupled gyroscopes as a case study. *Physica D*, 2014 (In Print).
- [35] P.L. Buono and A. Palacios. Heart motorneuron dynamics of leeches. In *7th Experimental Chaos Conference*, volume 676, pages 257–262, 2003.
- [36] P.L. Buono and A. Palacios. A mathematical model of motorneuron dynamics in the heartbeat of the leech. *Physica D*, 188:292–313, 2004.
- [37] P. Cizmas and A. Palacios. Proper orthogonal decomposition of turbine rotor-stator interaction. *Journal of Propulsion and Power*, 19(2):268–281, 2003.
- [38] P. Cizmas, A. Palacios, T. O'Brien, and M. Syamlal. Proper orthogonal decomposition of spatial-temporal patterns in fluidized beds. *Chem. Engineering Science*, 58:4417–4427, 2003.
- [39] N. Davies, H. Vu, A. Palacios, V. In, and P. Longhini. Collective behavior of a coupled gyroscope system with coupling along the drive and sense modes. *International Journal of Bifurcation and Chaos*, To Appear, 23(1):1350006, 2013.
- [40] L. Demasi and A. Palacios. A reduced-order nonlinear aeroelastic analysis of joined wings based on the proper orthogonal decomposition. In *51st AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, pages 1–26, 2010.
- [41] M. Hernandez, V. In, P. Longhini, A. Palacios, A. Bulsara, and A. Kho. Coupling-induced oscillations in nonhomogeneous, overdamped, bistable systems. *Physics Letters A*, 372(24):4381–4387, 2008.
- [42] V. In, A. Bulsara, A. Kho, A. Palacios, S. Baglio, B. Ando, and V. Sacco. Exploiting dynamic cooperative behavior in a coupled-core fluxgate magnetometer. In Salvatore Baglio and Adi Bulsara, editors, *Device Applications of Nonlinear Dynamics*, pages 67–82, Catania, Italy, 2006.
- [43] V. In, A. Bulsara, A. Kho, A. Palacios, S. Baglio, B. Ando, and V. Sacco. Reconfigurable pattern generators using nonlinear electronic circuits. In Salvatore Baglio and Adi Bulsara, editors, *Device Applications of Nonlinear Dynamics*, pages 245–252, Catania, Italy, 2006.
- [44] V. In, A. Bulsara, A. Kho, A. Palacios, P. Longhini, J. Acebron, S. Baglio, and B. Ando. Self-induced oscillations in electronically coupled fluxgate magnetometers. In *8th Experimental chaos conference*, pages 57–62, Florence, Italy, 2004.
- [45] V. In, A. Bulsara, A. Palacios, S. Baglio, B. Ando, P. Longhini, J. Neff, B. Meadows, and A. Bulsara. Self-induced oscillations in coupled fluxgate magnetometers: a novel approach to operating the magnetic sensors. In *2004 International Symposium on Circuit and Systems*, volume 4, pages 736–739, 2004.
- [46] V. In, A. Bulsara, A. Palacios, P. Longhini, and A. Kho. Complex dynamics in unidirectionally coupled overdamped bistable systems subject to a time-periodic external signal. *Physical Review E Rapid Communications*, 72(4):045104, 2005.
- [47] V. In, A. Bulsara, A. Palacios, P. Longhini, A. Kho, and J. Neff. Coupling induced oscillations in overdamped bistable systems. *Physical Review E Rapid Communications*, 68:045102–1–045102–4, 2003.
- [48] V. In, A. Kho, A. Bulsara, J. Neff, S. Baglio, V. Sacco, A. Palacios, and P. Longhini. Coupling nonlinear sensors for enhanced sensitivity: A prototype using the three coupled-core fluxgate

- magnetometer. In *Proceedings of the 4th IEEE Conference on Sensors*, pages 57–60, Irvine, California, 2006.
- [49] V. In, A. Kho, P. Longhini, and A. Palacios. Coupled overdamped bistable systems with applications to sensor devices. *Focus Issue of Nonlinear Theory and its Applications, IEICE*, 3(4):477–496, 2012.
- [50] V. In, A. Kho, J. Neff, A. Palacios, P. Longhini, and B. Meadows. Experimental observation of multifrequency patterns in arrays of coupled nonlinear oscillators. *Physical Review Letters*, 91(24):244101–1–244101–4, 2003.
- [51] V. In, P. Longhini, A. Kho, N. Liu, S. Naik, A. Palacios, and J. Neff. Frequency down-conversion using cascading arrays of coupled nonlinear oscillators. *Physica D*, 240:701–708, 2011.
- [52] V. In, P. Longhini, A. Kho, J.D. Neff, D. Leung, N. Liu, B.K. Meadows, F. Gordon, and A. Palacios. Nonlinear channelizer. *Chaos, Special Focus Issue: "Fifty Years of Chaos: Applied and Theoretical"*, 22:047514, 2012.
- [53] V. In, P. Longhini, N. Liu, A. Kho, J. Neff, A. Palacios, and A. Bulsara. A bistable microelectronic circuit for sensing extremely low electric field. *Journal of Applied Physics*, 107:014506, 2010.
- [54] V. In, A. Palacios, A. Bulsara, P. Longhini, A. Kho, Joseph Neff, Salvatore Baglio, and Bruno Ando. Complex behavior in driven unidirectionally coupled overdamped duffing elements. *Physical Review E*, 73(6):066121, 2006.
- [55] V. In, V. Sacco, A. Kho, S. Baglio, B. Ando, A. Bulsara, and A. Palacios. Exploiting nonlinear dynamics in a coupled core fluxgate magnetometer. *Measurement Science and Technology*, 19:075203, (2008).
- [56] V. In J. Turtle, A. Palacios and P. Longhini. The dynamics of coupled spin-torque nano oscillators. an initial exploration. In *International Conference on Theory and Application in Nonlinear Dynamics*, pages 285–291. Springer, 2013.
- [57] J.D. Kelley, G.H. Gunaratne, A. Palacios, and J. Shulman. Modal decomposition and normal form for hydrodynamic flows: Examples from cellular flame patterns. *The European Physical Journal Special Topics*, 204:119–131, 2012.
- [58] P. Longhini, S. Berggren, A.L. de Escobar, A. Palacios, S. Rice, B. Taylor, V. In, O. Mukhanov, G. Prokopenko, M. Nisenoff, E. Wong, and M.C. de Andrade. Voltage response of nonuniform arrays of bi-superconductive quantum interference devices. *Journal of Applied Physics*, 111:093920, 2012.
- [59] P. Longhini, S. Berggren, A. Palacios, and A.L. de Escobar. Coupled non-uniform bi-squid: A numerical investigation. In *AIP Conference Proceedings, Advances on Cryogenic Engineering: Transactions of the Cryogenic Conference (CEC/ICMC)*, volume 1434, pages 1167–1174, 2012.
- [60] P. Longhini, S. Berggren, A. Palacios, A.L. de Escobar, and V. In. Coupled serial and parallel non-uniform squids. In *International Conference on Applications in Nonlinear Dynamics*, volume 1339, pages 254–259, Lake Louis, CANADA, 2011.
- [61] P. Longhini, S. Berggren, A. Palacios, V. In, and A.L. de Escobar. Modeling non-locally coupled dc squid arrays. *IEEE Transactions on Applied Superconductivity*, 21(3):391–393, 2011.
- [62] P. Longhini, A. Palacios, V. In, J. Neff, A. Kho, and A. Bulsara. Exploiting dynamical symmetry in coupled nonlinear elements for efficient frequency down-conversion. *Physical Review E*, 76:026201, 2007.
- [63] D. Lyons, J. Mahaffy, A. Palacios, V. In, P. Longhini, and A. Kho. Basins of attraction in a ring of overdamped bistable systems with delayed coupling. *Physics Letters A*, 374:2709–2722, 2010.
- [64] D. Lyons, J. Mahaffy, S. Wang, A. Palacios, and V. In. Geometry of basins of attraction and heteroclinic connections in coupled bistable systems. *International Journal of Bifurcation and Chaos*, 2014 (in print).

- [65] A. Matus-Vargas, A. Palacios, H. Gonzalez, V. In, S. Naik, and A. Phipps. Arrays of coupled magnetostrictive energy harvesters. *International Journal of Bifurcation and Chaos*, 2014 (In Print).
- [66] S. Naik, T. Hikihara, A. Palacios, V. In, H. Vu, and P. Longhini. Characterization of synchronization in a unidirectionally coupled system of nonlinear micromechanical resonators. *Sensors and Actuators A*, 171(2):361–369, 2011.
- [67] S. Naik, T. Hikihara, H. Vu, A. Palacios, V. In, and P. Longhini. Local bifurcations of synchronization in self-excited and forced unidirectionally coupled micromechanical resonators. *Journal of Sound and Vibration*, 331(5):1127–1142, 2011.
- [68] S. Naik, A. Phipps, V. In, Peyton Cavaroc, A. Matus-Vargas, A. Palacios, and H. Gonzalez. Energy harvesting with coupled magnetostrictive resonators. In Wei-Hsin Liao, editor, *SPIE Proceedings. Active and Passive Smart Structures and Integrated Systems 2014*, volume 9057, March 2014.
- [69] J. Neff, V. In, C. Obara, and A. Palacios. Applications of nonlinear and reconfigurable electronic circuits. In *Applications of Nonlinear Dynamics*, pages 119–132, San Diego, California, 2009. Springer-Verlag.
- [70] A. Palacios. Symmetry-breaking bifurcations in simulations of the kuramoto-sivashinky equation. In *First Compaq-Sponsored Conference on Computational Science*, 2000.
- [71] A. Palacios. Cycling chaos in one-dimensional coupled iterated maps. *International Journal of Bifurcation and Chaos*, 12(8):1859–1868, 2002.
- [72] A. Palacios. Heteroclinic cycles in coupled systems of difference equations. *Int. J. Diff. Eq. Appl.*, 9(7):671–686, (2002).
- [73] A. Palacios. Identification of modulated rotating waves in pattern-forming systems with $o(2)$ symmetry. *Discrete and Continuous Dynamical Systems*, B 2(1):129–147, 2002.
- [74] A. Palacios. Heteroclinic cycles. *Scholarpedia*, page 8163, 2007.
- [75] A. Palacios, D. Armbruster, E. Kostelich, and E. Stone. Analyzing the dynamics of cellular flames. *Physica D*, 60:132–161, 1996.
- [76] A. Palacios, J. Aven, V. In, P. Longhini, A. Kho, J. Neff, and A. Bulsara. Coupled-core fluxgate magnetometer: Novel configuration scheme and the effects of a noise-contaminated external signal. *Physics Letters A*, 367:25–34, 2007.
- [77] A. Palacios, J. Aven, P. Longhini, V. In, and A. Bulsara. Cooperative dynamics in coupled noisy dynamical systems near a critical point; the dc squid as a case study. *Physical Review E*, 74:021122, 2006.
- [78] A. Palacios, P. Blomgren, and S. Gasner. Bifurcation analysis of hopping behavior in cellular pattern-forming systems. *International Journal of Bifurcation and Chaos*, 17(2):509–520, 2007.
- [79] A. Palacios, R. Carretero-Gonzalez, P. Longhini, N. Renz, V. In, A. Kho, J. Neff, B. Meadows, and A. Bulsara. Multifrequency synthesis using two coupled nonlinear oscillator arrays. *Physical Review E*, 72:026211, 2005.
- [80] A. Palacios, C. Finney, P. Cizmas, S. Daw, and T. O'Brien. Experimental analysis and visualization of spatio-temporal bubble patterns in fluidized beds. *Chaos*, 14(2):499–509, 2004.
- [81] A. Palacios, M. Gorman, and K. Robbins. Visualization, animation and kl decomposition of spatiotemporal dynamics in a pattern-forming system. In *4th Experimental Chaos Conference*, pages 31–36, 1997.
- [82] A. Palacios, L. Gross, and A. Rockwood. Dynamics and chaos: the spherical pendulum. *Computer Graphics Forum*, 15(4):263–270, 1996.
- [83] A. Palacios, G. Gunaratne, and M. Gorman. Modal decomposition of hopping motion in cellular flame patterns. *Chaos*, 9:755–767, 1999.

- [84] A. Palacios, G. Gunaratne, M. Gorman, and K. Robbins. Cellular pattern formation in circular domains. *Chaos*, 7(3):463–475, 1997.
- [85] A. Palacios, G. Gunaratne, M. Gorman, and K. Robbins. A karhunen-loève analysis of spatiotemporal flame patterns. *Physical Review E*, 57(5):5958–5971, 1998.
- [86] A. Palacios, V. In, P. Longhini, and A. Kho. Symmetry induced heteroclinic cycles in coupled sensor devices. In T. Hikihara, editor, *IUTAM Symposium on 50 Years of Chaos : Applied and Theoretical*, volume 5, pages 144–150, Tokyo, Japan, 2012. Elsevier.
- [87] A. Palacios and H. Juarez. Cryptography with cycling chaos. *Physics Letters A*, 303:345–351, 2002.
- [88] A. Palacios and P. Longhini. Cycling behavior in near-identical cell systems. *International Journal of Bifurcation and Chaos*, 13(9):2719–2732, 2003.
- [89] A. Palacios, H. Vu, V. In, and P. Longhini. Symmetry-based design and fabrication of novel sensor systems. In I. Kotsireas, R. Melnik, and B. West, editors, *Advances in Mathematical and Computational Methods: Addressing Modern Challenges of Science, Technology and Society*, volume 1368, pages 97–100, Melville, New York, 2011. American Institute of Physics.
- [90] B. Chan P.L. Buono and A. Palacios. A network of symmetrically coupled gyroscopes. In I. Kotsireas, R. Melnik, and B. West, editors, *Advances in Mathematical and Computational Methods: Addressing Modern Challenges of Science, Technology and Society*, volume In print, Melville, New York, 2014. American Institute of Physics.
- [91] G. Prokopenko, O. Mukhanov, A.L. de Escobar, B. Taylor, M.C. de Andrade, S. Berggren, P. Longhini, A. Palacios, and M. Nisenoff. Dc and rf measurements of wideband serial bi-squid arrays. *IEEE Transactions on Applied Superconductivity*, 23:1400607, 2013.
- [92] J. Turtle, K. Beauvais, A. Palacios, V. In, and P. Longhini. Coherence in arrays of spin-torque nano oscillators. In *Nanotech 2014 Conference Proceedings*, volume In Print, 2014.
- [93] J. Turtle, K. Beauvais, R. Shaffer, A. Palacios, T. Emery, V. In, and P. Longhini. Gluing bifurcations in coupled spin torque nano-oscillators. *Journal of Applied Physics*, 113(11):114901–114901–10, 2013.
- [94] H. Vu, A. Palacios, V. In, P. Longhini, and J. Neff. Two-time scale analysis of a ring of coupled vibratory gyroscopes. *Physical Rev. E.*, 81:031108, 2010.
- [95] H. Vu, A. Palacios, V. In, P. Longhini, and J. Neff. A drive-free vibratory gyroscope. *Chaos*, 21:013103, 2011.
- [96] H. Vu, A. Palacios, V. In, P. Longhini, and J. Neff. An overview of a perturbation analysis for unidirectionally coupled vibratory gyroscopes. In V. In, P. Longhini, and A. Palacios, editors, *Proceedings of the 2nd International Conference on Applications in Nonlinear Dynamics*, volume 1339, page 309. AIP, 2011.
- [97] D. Zhang, G. Wei, D. Kouri, D. Hoffmann, M. Gorman, G. Gunaratne, and A. Palacios. Integrating the kuramoto-sivashinsky equation in a circular domain. *Physical Review E*, 60(3):3353–3360, 1999.