Konstantinos S. Tsakalis

Professor

ECEE Undergraduate Program Chair

School of Electrical Computer and Energy Engineering, Ira A. Fulton Schools of Engineering
Arizona State University, Tempe, AZ 85287-5706
ph.: (480) 965-1467,   e-mail: tsakalis@asu.edu,   `http://tsakalis.faculty.asu.edu`

Areas of Teaching and Research

- *General Topics:*
  Control theory. Robust and adaptive control, time-varying systems (SISO and MIMO), performance guarantees and limitations. Estimation theory and system identification. Nonlinear systems. Optimization theory and optimal control. Implementation of embedded control systems using MATLAB, rapid prototyping.

- *Integrated system identification and controller design:*
  Dynamic uncertainty estimation and multivariable controller design (loop-shaping). PID tuning. Controller performance monitoring. Controller implementation issues. Applications to semiconductor manufacturing and chemical process control. Applications to power systems.

- *Biomedical applications:*
  Prediction and control of epileptic seizures. Theoretical development and application to data from human and animal models. Feedback control experimentation in animal models.

- *Manufacturing process control:*
  Run-to-run control, process optimization, scheduling of operations.

- *Education:*
  Internet-based analysis and design tools (J-DSP-C), Embedded control systems using MATLAB and LAB-VIEW. Virtual lab experiments using PC104 and FPGA boards for process emulation and control, with realistic process I/O.

Publications

Summary: 1 Book, 14 Book Chapters, 55 Journal Papers, 10 Patents, 125 Conference papers.
Over 1468 Journal-only citations (source: ISI Web of Science, March 2018).

I. Books

1. K. S. Tsakalis and P. A. Ioannou, *Linear Time-Varying Systems: Control and Adaptation*, Prentice-Hall, Englewood Cliffs, New Jersey, 1993.

II. Book Chapters

1. Shafique A., Sayeed M., Tsakalis K. (2018) Nonlinear Dynamical Systems with Chaos and Big Data: A Case Study of Epileptic Seizure Prediction and Control. In: Srinivasan S. (eds) Guide to Big Data Applications. Studies in Big Data, vol 26. Springer, Cham

2. Serrano V., Thompson M., Tsakalis K. (2017) Learning Multivariable Controller Design: a Hands-on Approach with a Lego Robotic Arm. In: Chang I., Baca J., Moreno H., Carrera I., Cardona M. (eds) Advances in Automation and Robotics Research in Latin America. Lecture Notes in Networks and Systems, vol 13. Springer, Cham

3. Ioannis Vlachos, Aaron Faith, Steven Marsh, Jamie White-James, Kostantinos Tsakalis, David M. Treiman and Leon D. Iasemidis, "Brain Network Characteristics in Status Epilepticus," TM Rassias et al eds *Optimization in Science and Engineering*, Springer New York 543-552, 08 May 2014,

4. Jennie Si; Lei Yang; Chao Lu; Kostas S. Tsakalis; Armando A. Rodriguez, "Toward Design of Nonlinear ADP Learning Controllers with Performance Assurance Reinforcement Learning and Approximate Dynamic Programming for Feedback Control." *IEEE Press Series on Computational Intelligence,* IEEE Press, 182-202, 2013.

5. K. Tsakalis and S. Dash, "Identification for PID Control," in PID Control in the Third Millennium, A. Visioli, R. Villanova Eds., Chapter 10, 283-317, Springer-Verlag London Limited, 2012

6. S. Sabesan, L.D. Iasemidis, K. Tsakalis, D.M. Treiman, J. Sirven, "Use of dynamical measures in prediction and control of focal and generalized epilepsy," in: Epilepsy: The Intersection of Neurosciences, Biology, Mathematics, Engineering and Physics, Eds. H. Zaveri, I. Osorio, H. Zaveri, M.G. Frei, S. Arthurs, CRC Press, Boca Raton, FL, Ch.20, pp. 307-320, 2011.

7. S. Sabesan, K.Tsakalis, A. Spanias, L.D. Iasemidis, "A Robust Estimation of Information Flow in Coupled Nonlinear Systems," in Computational Neuroscience, Eds. W. Chaovalitwongse, P.M. Pardalos, P. Xanthopoulos, Springer Series on Optimization and its Applications, Springer Science, New York, v.38, 271-284, 2010.

8. A. Faith, S. Sabesan, N. Wang, D. Treiman, J. Sirven, K. Tsakalis, L.D. Iasemidis, "Dynamical analysis of the EEG and treatment of human status epilepticus by anti-epileptic drugs," in Computational Neuroscience, Eds. W. Chaovalitwongse, P.M. Pardalos, P. Xanthopoulos, Springer Series on Optimization and its Applications, Springer Science, New York, v.38, 305-316, 2010.

9. L.D. Iasemidis, S. Sabesan, N. Chakravarthy, A. Prasad, K.Tsakalis, "Brain Dynamics and Modeling in Epilepsy: Prediction and Control Studies," in Complex Dynamics of Physiological Systems: From Heart to Brain, Eds. S.K. Dana, P.K. Roy, J. Kurths, Springer Series on Complexity, Springer Verlag, The Netherlands, 185-214, 2009.

10. L.D. Iasemidis, S. Sabesan, L. Good, N. Chakravarthy, D. Treiman, J. Sirven, K.Tsakalis, "A new look into epilepsy as a dynamical disorder: seizure prediction, resetting and control," Encyclopedia of Basic Epilepsy Research, Ed. Philip Schwartzkroin, Elsevier, vol. 3, pp. 1295-1302, 2009.

11. H. Al-Nashash, S. Sabesan, B. Krishnan, J. George, K. Tsakalis, L. Iasemidis, S. Tong, "Single-Channel EEG Analysis," in *Quantitative EEG Analysis Methods and Clinical Applications,* Eds. Shanbao Tong and Nitish Thakor, Artech House, Norwood, MA, pp. 73-90, 2009.

12. S. Sabesan, L. Good, N. Chakravarthy, K. Tsakalis, P.M. Pardalos, L.D. Iasemidis, "Global optimization and spatial synchronization changes prior to epileptic seizures," Eds. C.J.S. Alves, P.M. Pardalos, L.N. Vicente, Optimization in Medicine, Coimbra, Portugal, July 20-22, 2005, Springer Series in Optimization and its Applications, Springer, pp. 103-125, 2008.

13. S. Sabesan, K. Narayanan, A. Prasad, L.D. Iasemidis, A. Spanias and K. Tsakalis, "Information flow in coupled nonlinear systems: Application to the epileptic human brain," In: *Data Mining in Biomedicine*, Series: Springer Optimization and Its Applications , Vol. 7, 483-504, P. Pardalos, V. Boginski, A. Vazacopoulos (Eds.), 2007.

14. P.A. Ioannou and K.S. Tsakalis, "Robust Discrete-Time Adaptive Control," in *Adaptive and Learning Systems: Theory and Applications*, Plenum Press, edited by K. S. Narendra, 1986.

III. Journal Papers

1. I. Vlachos, B. Krishnan, D. M. Treiman, K. Tsakalis, D. Kugiumtzis and L. D. Iasemidis, "The Concept of Effective Inflow: Application to Interictal Localization of the Epileptogenic Focus From iEEG," in IEEE Transactions on Biomedical Engineering, vol. 64, no. 9, pp. 2241-2252, Sept. 2017.

2. R. Joshi, K. Tsakalis, J.W. MacArthur, S. Dash, "Account for Uncertainty with Robust Control Design: Part 1," *Chemical Engineering Progress,* 31-38, Nov. 2014.

3. R. Joshi, K. Tsakalis, J.W. MacArthur, S. Dash, "Account for Uncertainty with Robust Control Design: Part 2," *Chemical Engineering Progress,* 46-50, Dec. 2014.

4. Steenis, J. ; Tsakalis, K. ; Ayyanar, R., "An Approach to Bumpless Control for LPV Modeled Inverters in a Microgrid" *IEEE Transactions on Power Electronics*, V.29, 11, 6214-6223, 2014.

5. Tsakalis, K. S., Dash, S. "Approximate H-inf loop shaping in PID parameter adaptation." *International Journal of Adaptive Control and Signal Processing,* 27(1-2), 136-152, 2013.

6. Tsakalis K, Vlassopoulos N, Lentaris G, Reisis D., "A Control-Theoretic Approach for Efficient Design of Filters in DAC and Digital Audio Amplifiers," *Circuits, Systems and Signal Processing*, 30, 2, 421-438, Apr. 2011.

7. L.B.Good, S. Sabesan, S.T. Marsh, K. Tsakalis, D.M. Treiman, L.D. Iasemidis, "Nonlinear Dynamics of Seizure Prediction in a Rodent Model of Epilepsy," Nonlinear Dynamics, Psychology and Life Sciences, v.14, 5, 411-434, 2010.

8. L. Yang, J. Si, K.S. Tsakalis, A.A. Rodriguez, A. A., "Direct Heuristic Dynamic Programming for Nonlinear Tracking Control With Filtered Tracking Error," IEEE Transactions on Systems, Man, and Cybernetics, Part B: Cybernetics, Volume 39, Issue 6, 1617 - 1622, Dec. 2009.

9. L. Yang, J. Si, K.S. Tsakalis, A.A. Rodriguez, A. A., "Performance Evaluation of Direct Heuristic Dynamic Programming Using Control-Theoretic Measures," J. Intell. Robot Syst., 55, 177 - 201, 2009.

10. Iasemidis LD, Tsakalis KS, Osorio I, et al., "Special Issue: Neuromodulation and Control of Epileptic Seizures, INTRODUCTION," *Int. J. of Neural Systems,* V.19, 3 Pages: V-VII, June 2009.

11. S. Sabesan, L.B. Good, K.S. Tsakalis, A. Spanias, D.M. Treiman, L.D. Iasemidis, "Information Flow and Application to Epileptogenic Focus Localization From Intracranial EEG," IEEE Transactions on Neural Systems and Rehabilitation Engineering, Volume 17, Issue 3, 244 - 253, June 2009.

12. L.B. Good, S. Sabesan, S.T. Marsh, K. Tsakalis, D.M. Treiman, L.D. Iasemidis, "Control of Synchronization of Brain Dynamics Leads to Control of Epileptic Seizures in Rodents," International Journal of Neural Systems (IJNS) Volume: 19, Issue: 3, pp. 173-196, 2009.

13. N. Chakravarthy, K. Tsakalis, S. Sabesan, L. Iasemidis, Homeostasis of Brain Dynamics in Epilepsy: A Feedback Control Systems Perspective of Seizures, Annals of Biomedical Engineering Volume 37, 3, 565-585, 2009.

14. N. Chakravarthy, S. Sabesan, K. Tsakalis, L. Iasemidis, "Controlling epileptic seizures in a neural mass model," *Journal of Combinatorial Optimization,* Springer Sci. and Bus. Media, 17: 98-116, Jan. 2009.

15. S. Sabesan, N. Chakravarthy, K. Tsakalis, L.D. Iasemidis, "Measuring resetting of brain dynamics at epileptic seizures: Application of global optimization and spatial synchronization techniques", *Journal of Combinatorial Optimization,* Springer Sci. and Bus. Media, 17: 74-97, Jan. 2009.

16. Venkatraman Atti, Andreas Spanias, Kostas Tsakalis, Constantinos Panayiotou, Leon Iasemidis and Visar Berisha "Gradient Projection-Based Channel Equalization Under Sustained Fading," *Signal Processing,* Vol. 88, 2, 236-246, February 2008.

17. Kostas Tsakalis and Sachi Dash "Multivariable controller performance monitoring using robust stability conditions," *Journal of Process Control,* Vol. 17, 9, 702-714, October 2007.

18. Niranjan Chakravarthy, S. Sabesan, L.D. Iasemidis, K. Tsakalis, "Controlling synchronization in a neuron-level population model," *Intern. Journal of Neural Systems*, Vol. 17, No. 2, 123 - 138, April 2007.

19. A. Spanias, K. Huang, A. Natarajan, R. Ferzli, H. Kwon, V. Atti, V. Berisha, L. Iasemides, H. Krishnamoorthi, P. Spanias, S. Misra, M. Banavar, K. Tsakalis, S. Haag, "Interfacing Java-DSP with a TI DSK for use in a Signal Processing Class," ASEE Computers in Education Journal, Vol. XVII, No. 3, pp. 27-35, Issue: July-Sep. 2007.

20. Kostas Tsakalis and Leon Iasemidis, "Control Aspects of a Theoretical Model for Epileptic Seizures," *International Journal of Bifurcation and Chaos.* Special Issue "Complexity: A Unifying Direction in Science," Vol. 16,7, 2006.

21. K. Tsakalis, Niranjan Chakravarthy, S. Sabesan, L.D. Iasemidis, P.M. Pardalos, "A feedback control systems view of epileptic seizures," *Cybernetics and Systems Analysis*, vol. 42, pp.483-495, 2006.

22. Niranjan Chakravarthy, Kostas Tsakalis, Leon D. Iasemidis, Andreas Spanias, "A Multi-dimensional Scheme for Controlling Unstable Periodic Orbits in Chaotic Systems," *Physics Letters A,* Nonlinear Science, 349, 116-127, 2006.

23. Awadhesh Prasad, Leon D Iasemidis, Shivkumar Sabesan and Kostas Tsakalis "Dynamical hysteresis and spatial synchronization in coupled non-identical chaotic oscillators," *PRAMANA - Journal of Physics*, Vol.64, No.4, 513-523, Apr. 2005.

24. L.D. Iasemidis, D-S Shiau, P.M. Pardalos, W.Chaovalitwongse, K. Narayanan, A. Prasad, K. Tsakalis, P. Carney and J.C. Sackellares, "Long-term prospective on-line real-time seizure prediction", *Clinical Neurophysiology*, Elsevier, 116, 532-544, Jan. 2005.

25. L.D. Iasemidis, K. Tsakalis, J.C. Sackellares, and P.M. Pardalos, "Comment on "Inability of Lyapunov Exponents to Predict Epileptic Seizures," *Physical Review Letters* 94, 019801, week ending 14 Jan. 2005.

26. H. Wu, K.S. Tsakalis, G.T. Heydt, "Evaluation of Time Delay Effects to Wide-area Power System Stabilizer Design," *IEEE Transactions on Power Systems*, V.19, 4, 1935–1941, Nov. 2004.

27. K.S. Tsakalis and J.C. Palais, "Improving a School's *U.S. News and World Report* Ranking," *Journal of Engineering Education*, V.93, 3, 259-263, July 2004.

28. B. Veeramani, K. Narayanan, A. Prasad, L.D. Iasemidis, A.S. Spanias, K. Tsakalis, "Measuring the direction and the strength of coupling in nonlinear Systems-a modeling approach in the State space," *Signal Processing Letters,* IEEE, V. 11, 7, 617-620, July 2004.

29. T. Ogasawara, K. Tsakalis, C. Hornberg, "Improving Low-Temperature Control on a Vertical Furnace Using Model-Based Temperature Control," *Semiconductor Manufacturing,* Semi, V. 5, 2, 161-166, Feb. 2004.

30. N. Chakravarthy, A. Spanias, L. D. Iasemidis, and K. Tsakalis, "Autoregressive Modeling And Feature Analysis Of DNA Sequences," *EURASIP* Jasp 2004:1 (2004) 13-28.

31. L.D. Iasemidis, D.-S. Shiau, W. Chaovalitwongse, J.C. Sackellares, P.M. Pardalos, J.C. Principe, P.R. Carney, A. Prasad, B. Veeramani, and K. Tsakalis, "Adaptive Epileptic Seizure Prediction System," *IEEE Transactions on Biomedical Engineering*, 50, 5, 616-627, May 2003.

32. K. Tsakalis, S. Dash, A. Green and W. MacArthur, "Loop-shaping controller design from input-output data: application to a paper machine simulator," *IEEE Transactions on Control Systems Technology,* Vol. 10, No. 1, 127-136, Jan. 2002.

33. E. Grassi, K. Tsakalis, S. Dash, S.V. Gaikwad, W. MacArthur and G. Stein, "Integrated Identification and PID Controller Tuning by Frequency Loop-Shaping," *IEEE Trans. Contr. Systems Technology*, 9, 2, 285-294, March 2001.

34. Suttipan Limanond and K.S. Tsakalis, "Adaptive and non-adaptive 'pole-placement' control of multivariable linear time-varying plants," *Int. J. Control*, 74, 5, 507-523, 2001.

35. Suttipan Limanond and K.S. Tsakalis, "Model Reference Adaptive and Nonadaptive Control of Linear Time-Varying Plants," *IEEE Trans. Automat. Contr.*, 45, 7, 1290-1300, July 2000.

36. E. Grassi and K. Tsakalis, "PID Controller Tuning by Frequency Loop-Shaping: Application to Diffusion Furnace Temperature Control," *IEEE Trans. Contr. Systems Technology*, 8, 5, 842-847, Sept. 2000.

37. M. Beaudoin, E. Grassi, S.R. Johnson, K. Ramaswamy, K. Tsakalis, T.L. Alford and Y.H. Zhang, "Real-time composition control of InAlAs grown on InP using spectroscopic ellipsometry," *J. Vac. Sci. Technol. B* 18(3), pp. 1435-1438 , May/Jun 2000.

38. Elena Grassi, Shane R. Johnson, Mario Beaudoin, and Kostas S. Tsakalis, "Temperature-composition determination based on modeling of optical constants of III-V compound semiconductors measured by spectroscopic ellipsometry," *J. Vac. Sci. Technol. B* 17(3), pp. 1223-1226 , May/Jun 1999.

39. S.R. Johnson, E. Grassi, M. Beaudoin, M.D. Boonzaayer, K.S. Tsakalis, and Y.H. Zhang, "Closed-loop control of composition and temperature during the growth of InGaAs lattice matched to InP," *J. Vac. Sci. Technol. B* 17(3), pp. 1237-1240 , May/Jun 1999.

40. S.R. Johnson, E. Grassi, M. Beaudoin, M.D. Boonzaayer, K.S. Tsakalis, Y.H. Zhang, "Feedback control of substrate temperature during the growth of near-lattice-matched InGaAs on InP using diffuse reflection spectroscopy," *Journal of Crystal Growth*, 201/202, pp. 40-44, 1999.

41. E. Grassi, S.R. Johnson, M. Beaudoin, K.S. Tsakalis, "Modeling of optical constants of InGaAs and InAlAs measured by spectroscopic ellipsometry," *Journal of Crystal Growth*, 201/202, pp. 1081-1084, 1999.

42. M. Yelverton, K. Tsakalis and K. Stoddard, "Factory-wide run-to-run process control," *Solid State Technology*, pp. 45-52, Dec. 1999.

43. S. Limanond, J. Si and K.S. Tsakalis, "Monitoring and Control of Semiconductor Manufacturing Processes," *IEEE Control Systems,* V. 18, 6, 46-58, Dec. 1998.

44. K.S. Tsakalis, "Bursting Scenaria in Adaptive Algorithms: Performance Limitations and Some Remedies," *Kybernetika*, 33, 1, 17–40, 1997.

45. K.S. Tsakalis, "Performance Limitations of Adaptive Parameter Estimation and System Identification Algorithms in the Absence of Excitation," *Automatica*, 32, 4, 549–560, 1996.

46. K.S. Tsakalis, M. Deisher and A. Spanias, "System Identification Based on Bounded Error Constraints," *IEEE Trans. Signal Proc.*, 43, 12, 3071–3075, Dec. 1995.

47. K.S. Tsakalis and Suttipan Limanond, "Asymptotic Performance Guarantees in Adaptive Control," *Int. J. of Adaptive Control and Signal Processing*, Vol. 8, 173–199, 1994.

48. K.S. Tsakalis, "Adaptive Control of Linear Time-Varying Plants: The Case of "Jump" Parameter Variations," *Int. Journal of Control* Vol. 56, No. 6, pp. 1299–1345, 1992.

49. K.S. Tsakalis, "Robustness of Model Reference Adaptive Controllers: An Input-Output Approach," *IEEE Trans. Automat. Contr.*, Vol. 37, No. 5, pp. 556–565, May 1992.

50. K.S. Tsakalis and P.A. Ioannou, "A New Indirect Adaptive Control Scheme for Time-Varying Plants," *IEEE Trans. Automat. Contr.*, AC-35, No. 6, pp. 697–705, June 1990.

    • Also in *"Advances in Adaptive Control.* Edited by K.S. Narendra, R. Ortega and P. Dorato, IEEE Press, Piscataway NJ, 1991." (Selected reprints providing a review of the then state-of-the-art in adaptive control.)

51. K.S. Tsakalis and P.A. Ioannou, "Adaptive Control of Linear Time-Varying Plants: A New Model Reference Controller Structure," *IEEE Trans. Automat. Contr.*, AC-34, pp. 1038–1046, Oct. 1989.

52. K.S. Tsakalis and P.A. Ioannou, "Adaptive Control of Time-Varying Plants: Simple Examples," *Int. J. of Adaptive Control and Signal Processing*, Vol. 2, pp. 291–309, Dec. 1988.

53. K.S. Tsakalis and P.A. Ioannou, "Adaptive Control of Linear Time-Varying Plants," *Automatica*, Vol. 26, No. 4, pp. 459–468, July 1987.

54. P.A. Ioannou and K.S. Tsakalis, "A Robust Direct Adaptive Controller," *IEEE Trans. Automat. Contr.*, AC-31, No. 11, pp. 1033 – 1043, Nov. 1986.

55. K.S. Tsakalis, T.T. Tsotsis and G.J. Stiegel, "Deactivation Phenomena by Site Poisoning and Pore Blockage: The Effect of Catalyst Size, Pore Size and Pore Size Distribution," *Jour. of Catalysis*, 88, 188–202, July 1984.

IV. Patents

1. Jassemidis, Leonidas, D; Tsakalis, Konstantinos, S; "Pacemaker for treating physiological system dysfunction," *U.S. Pat. No. 8,197,395*, June 12, 2012.

2. S.V. Gaikwad, S.K. Dash, K.S. Tsakalis, "On-demand auto-tuner for a plant control system," *U.S. Patent No. 7,920,929*, April 5, 2011.

3. S.K. Dash, S.V. Gaikwad, K.S. Tsakalis, "Apparatus and method for controller performance monitoring in a process control system," *U.S. Patent No. 7,787,978*, August 31, 2010.

4. S.V. Gaikwad, S.K. Dash, K.S. Tsakalis, and G. Stein, "Auto-tuning controller using loop-shaping," *U.S. Patent No. 7,024,253*, April 4, 2006.

5. K.D. Stoddard, B.D. Schulze, and K. Tsakalis, "Run-to-run controller for use in microelectronic fabrication," *U.S. Patent No. 6,587,744*, July 1, 2003.

6. K. Stoddard, P.R. McHugh, and K. Tsakalis, "Temperature Control System for a Thermal Reactor," *U.S. Patent No. 6,441,350*, August 27, 2002.

7. K. Stoddard, P.R. McHugh, and K. Tsakalis, "Temperature Control System for a Thermal Reactor," *U.S. Patent No. 6,222,164 B1*, April 24, 2001.

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9. K. Stoddard, P.R. McHugh, and K. Tsakalis, "Temperature Control System for a Thermal Reactor," *U.S. Patent No. 6,207,937 B1*, March 27, 2001.

10. K. Stoddard, J.B. Hugues, and K. Tsakalis, "Model Based Temperature Controller for Semiconductor Thermal Processors," *U.S. Patent No. 5,895,596*, April 20, 1999.

V. Technical Reports

1. C. Taft, P. Wolf, K. Tsakalis, "Advanced Pulverizer Control: Design and Testbed Implementation," Final Report, EPRI, Palo Alto, CA, March 2004, 1004423.

VI. Conference Papers (Refereed and Invited)

1. A.B. Shafique, R. Joshi and K. Tsakalis, "Control relevant system identification using multiple short data sets," 2017 IEEE Conference on Control Technology and Applications (CCTA), Mauna Lani, HI, 2017, pp. 1728-1733.

2. Ashfaque B. Shafique, Darpan Saha, Steven T. Marsh, David M. Treiman, and Konstantinos Tsakalis, "A New Method for Seizure Detection using a Modified Kantz Algorithm for Lyapunov Exponent Estimation," American Epilepsy Society Annual Meeting Abstracts: (Abst. 2.141), 2017 December 1-5, Washington DC.

3. Georgis, G., Menoutis, G., Reisis, D., Tsakalis, K., Shafique, A. B. (2016). Towards real-time neuronal connectivity assessment: A scalable pipelined parallel generalized partial directed coherence engine. In Proceedings of the IEEE International Conference on Electronics, Circuits, and Systems. (Vol. 2016-March, pp. 13-16). [7440237] Institute of Electrical and Electronics Engineers Inc..

4. Victoria Serrano, Konstantinos Tsakalis, "A study on the on-line system identification and PID tuning of a buck converter," 2016 IEEE 13th International Conference on Networking, Sensing, and Control (ICNSC), 28-30 April 2016.

5. T. Yao, I. Leonard, R. Ayyanar and K. Tsakalis, "Mu synthesized robust controller for multi-SST islanded smart grid," 2016 IEEE Energy Conversion Congress and Exposition (ECCE), Milwaukee, WI, 2016.

6. V. Serrano and K. Tsakalis, "A Study on the On-Line System Identification of a Buck Converter", 13th International Conference on Dynamical systems-Theory and Applications, Lodz, Poland, December 7-10, 2015.

7. V. Serrano and K. Tsakalis, "System Identification and PID Tuning of a Buck Converter", SHPE RISE Symposia, Baltimore, November 15th, 2015. (Finalist to best paper).

8. V. Serrano, M. Thompson, K. Tsakalis, "Multivariable Controller Design of a Lego Mindstorm NXT Robotic Arm", Proceedings of the 2nd International Conference of Control, Dynamic Systems, and Robotics, Ottawa, Ontario, Canada, May 7-8 2015, pp. 186-1 to 186-9. Available at `http://avestia.com/CDSR2015_Proceedings/papers`

9. Venkataraman, V. ; Vlachos, I. ; Faith, A. ; Krishnan, B. ; Tsakalis, K. ; Treiman, D. ; Iasemidis, L., "Brain dynamics based automated epileptic seizure detection," *Proc. 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC),* 946 - 949, 2014.

10. Georgis, G. ; Reisis, D. ; Skordilakis, P. ; Tsakalis, K. ; Bin Shafique, A. ; Chatzikonstantis, G. ; Lentaris, G., "Neuronal connectivity assessment for epileptic seizure prevention: Parallelizing the generalized partial directed coherence on many-core platforms," *Proc. 2014 International Conference on Embedded Computer Systems: Architectures, Modeling, and Simulation (SAMOS XIV),* 359 - 366, 2014.

11. Steenis, J. ; Breazeale, L. ; Tsakalis, K. ; Ayyanar, R., "$H - \infty$ and gain scheduled $H - \infty$ control for islanded microgrids," *Proc. Energy Conversion Congress and Exposition (ECCE),* 4603 - 4608, 2013.

12. K. Tsakalis, "Real-time considerations in the localization and control of epileptic seizures," Presentation and Abstract in *1st Hellenic Forum for Science, Technology, and Innovation, EKEFE Dimokritos,* 17-19 Jul 2013, Athens, Greece (I).

13. K. Tsakalis, "Parameter Estimation for Identification in H-infinity," Presentation and Abstract In *Control and Adaptation: A 30-year journey,* Workshop, 24-Jun-2013, Larnaca, Cyprus.

14. Steenis, J.; Tsakalis, K.; Ayyanar, R. "Robust control of an islanded microgrid," *Proc. IECON 2012 - 38th Annual Conference on IEEE Industrial Electronics Society,* 2447 - 2451, 2012.

15. Ashfaque B.Shafique and Konstantinos Tsakalis, "Discrete-Time PID Controller Tuning Using Frequency Loop-Shaping," Proc. IFAC Conference on Advances in PID Control (PID'12), (6 pages), Brescia March 27-30, 2012.

16. L. Iasemidis, I. Vlachos, B. Krishnan, R. Sidique, E. Tobin, V. Venkataraman, A. Faith, S. Prasanna, A. Shafique, K. Tsakalis, S. Marsh, D. Treiman, S. Sabesan, S. Maschino, "Reduction of seizure frequency by responsive just-in-time VNS in an animal model of chronic epilepsy," 66th American Epilepsy Society Annual meeting, San Diego, CA, December, 2012.

17. I. Vlachos, B. Krishnan, R. Sidique, E. Tobin, V. Venkataraman, A. Faith, S. Prasanna, A. Shafique, K. Tsakalis, L. Iasemidis, S. Marsh, D. Treiman, S. Sabesan, S. Maschino, "Long-term effect of VNS on seizure burden in an animal model of chronic epilepsy," 66th American Epilepsy Society Annual meeting, San Diego, CA, December, 2012.

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Sponsored Research Projects

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2. C. Torres (PI), B. Rittmann, K. Tsakalis, "Wastewater Treatment Using Microbial Fuel Cells with Peroxide Production," DOD-SERDP, 9/28/2012 - 9/27/2015, $1,901,602

3. L. Iasemidis(PI), K. Tsakalis, D. Treiman, "Characterization of Novel Vagus Nerve Stimulation (VNS) Parameters Efficacy, Based on Desynchronization of Brain Dynamics, in Open and Closed-Loop Configurations: A Study in an Animal Model of Chronic Epilepsy," Cyberonics Inc., 05/27/10-10/31/11, $560,000.

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5. L. Iasemidis(PI), J. Sirven, K. Tsakalis, "Optimizing Multidimensional Time Series Classification: Spatio-Temporal Data Mining in Epileptic Brain Dynamics," Science Foundation of Arizona CAA 0281-08; Jul.08-Jul.09, $267,000

6. A.A. Rodriguez (PI), J. Anderies, N. Macia, K. Tsakalis, B. Welfert, "Evaluation of a Suite of Interactive Modeling, Controls, Rapid Prototyping, and Embedded System E-Book Modules," National Science Foundation, DUE-0817584, 7/15/2009 - 12/31/2010 $49,910.

7. K. Tsakalis (PI), L. Iasemidis, and D. Treiman, "Cyber Systems: Closed-Loop Control of Brain Dynamics in Epilepsy ," National Science Foundation, ECS-0601740, June 1, 2006 - May 31, 2010 $240,000.

8. K. Tsakalis (PI), J. Si, and A. Rodriguez, "Embedded Control Systems II," Consortium for Embedded Systems, 11/1/2005-12/31/2006 (5/15/2007), $43,013.

9. L. Iasemidis (PI), K. Tsakalis, and D. Treiman, "Seizure Control by Closed Loop Feedback in a Rat Model of Chronic Temporal Lobe Epilepsy," Epilepsy Foundation, July 1, 2005 - June 30, 2006 $100,000.

10. A. Rodriguez, (PI), K. Tsakalis, D. Allee, J. Si, "Rapid Prototyping for Embedded System Applications Via High Level Development Tools," NSF, DUE 0443133, 5/1/2005-4/30/2007, $75,000

11. J. Si (PI), A. Rodriguez, K. Tsakalis, "A Control-Theoretic Approach to Learning and Approximate Dynamic Programming (ADP) with Applications to High Performance Racing," NSF, 5/1/04-4/30/07, $190,000.

12. A. Rodriguez (PI), J. Si, K. Tsakalis, "A Flexible Embedded System Architecture and Methodology for Integrated Real-Time Helth Monitoring, Modeling, Control Law Design, and Implementation," Consortium for Embedded and Internetworking Technologies, 8/25/04-8/24/05, $75,137.

13. K. Tsakalis (PI), J. Si, and A. Rodriguez, "Embedded Control Systems: Undergraduate Course Development," Consortium for Embedded and Internetworking Technologies, 1/1/04-5/15/05, $56,588.

14. A. Spanias (PI), T. Duman, L. Karam, A. Papandreou, and K. Tsakalis, "On Line Undergraduate Laboratories in Signal and Image Processing, Communications, and Controls," NSF DUE 0089075, 1/1/01 – 12/31/03, $425,000.

15. K.S. Tsakalis, "Advanced Process Control in Semiconductor Manufacturing," SEMY Engineering/Brooks Automation, 8/15/95 – 8/14/03, $188,027.

   — Equipment Donation, 1999-2001, $325,000.

16. A.A. Rodriguez (PI), W. Higgins, J. Si, K.S. Tsakalis, and F. Hoppensteadt, "MOSART: A Model Undergraduate Multidisciplinary Controls Laboratory," NSF DUE 9851422, 8/15/98 – 7/31/01, $95,442.

17. K.S. Tsakalis, "Advanced Process Control In Paper Production," Honeywell Technology Center, Phoenix, 9/1/98–8/31/99, $24,999.

18. K. Tsakalis (PI) and A. Rodriguez, "Integrated Multi-Sensor Control for MBE Control of III-V Nanostructures." ARPA, 7/7/95–9/28/98, $150,041. (ASU, Sensor group; part of a multi-univeristy/industry proposal)

19. K.S. Tsakalis (PI) and D.E. Rivera, "A Control-Theoretic Approach to Scheduling of Semiconductor Fabrication Processes," INTEL Research Council, 1/1/95–12/31/97, $111,000.

20. D.E. Rivera (PI) and K.S. Tsakalis, "Benefits of Advanced Process Control Methods in Semiconductor Manufacturing," Motorola SPS, 2/1/96–5/31/96, $15,732.

21. P.E. Crouch (PI), T.S. Cale, G.B. Raupp, D.K. Ferry, M.N. Kozicki, K.S. Tsakalis and C. Ringhofer, "Mathematical Modeling for Simulation and Control of Semiconductor Processing," DoD-URI (ARPA), 10/1/92–5/31/96, $693,000.

22. W.T. Higgins (PI), P.E. Crouch, A.A. Rodriguez and K.S. Tsakalis, "Undergraduate Control Systems Design Laboratory," NSF, USE-9251934, 5/1/92–10/31/94, $50,232.

23. K.S. Tsakalis, "Parameter Estimation In Adaptive Control," NSF-RIA, ECS-9111346 9/1/91–2/28/94, $59,956.

24. D. Rivera (PI) and K.S. Tsakalis, "Robust Adaptive Process Control of Chemical Processes with Implementation on the TDC 3000," (within the "ASU-Honeywell Control Systems Engineering Program" by D. Shunk and D. Rivera) Honeywell Industrial Automation and Controls Division; 3/26/93–3/25/94 and 4/16/92–8/7/92, $12,284 (Summer support).

Internal Grants

1. L. Iasemidis (PI), J. Si, A. Spanias and K. Tsakalis, "Dynamical Modeling and Control of Epileptic Seizures," Fulton School of Engineering, Seed Funding Award, $48,000, June 2003-June 2004.

2. K.S. Tsakalis, ASU-RIA on the project "Design of Estimators for Adaptive Controllers with Robust Performance," 9/5/89–9/4/90, $20,000 (funds from VPR and EE Dept).

3. K.S. Tsakalis, "Design of Robust Adaptive Controllers," DWR-B594, ASU-FGIA, 1/1/89–12/31/89, $3,285.

4. K.S. Tsakalis, "Performance Issues in Adaptive Control," DWR-B677, ASU-FGIA, 1/1/90–12/31/90, $3,000.

Graduated Students

Ph.D.

- E. Khalid (Dec. 2017) Fractional Order PID Controller Tuning by Frequency Loop-Shaping: Analysis and Applications

- A. Shafique (Dec. 2016) Detection, Prediction and Control of Epileptic Seizures

- V.M. Serrano-Rodriguez (Dec. 2016) PID Controller Tuning and Adaptation of a Buck Converter

- C. Zhan (August 2008): System Identification for Robust Control.

- J. Dankert (May 2008, with J. Si): Approaches to Asynchronous Control of Motor Cortical Neural Prosthetics.

- S. Sabesan (May 2008, with L. Iasemidis): Spatiotemporal Brain Dynamics In Epilepsy: Application To Seizure Prediction And Focus Localization.

- N. Chakravarthy (May 2007, with L. Iasemidis): Modeling and Controlling Epileptic Seizures - A Feedback Control Systems Perspective

- J.J. Flores-Godoy (Dec. 2002): Nonlinear identification for diffusion/Chemical Vapor Deposition furnaces.

- E. Grassi (Dec. 1999): Proportional-integral-derivative controller tuning by frequency loop-shaping.

- G. Nair (Apr. 1998, with A. Spanias): Fast adaptive algorithms using eigenspace projections.

- L. Song (May 1997): Optimal control problems in chemical vapor deposition.

- A. Abdalla (May 1996): Control of linear time-varying systems.

- S. Limanond (Aug. 1994): Adaptive and non-adaptive control of multivariable linear time-varying plants.

M.S.

- Yiqiu Liu (Dec. 2015) System Identification Using Discontinuous Data Sets and PID Loop-shaping Control of A Vertical Take-off and Landing Drone

- Rakesh Joshi (Dec. 2013) A Study on Constrained State Estimators

- Ashfaque Md Shafique (Nov. 2011): Discrete-time PID Controller Tuning Using Frequency Loop Shaping.

- Rajendra Bhat (Dec. 2009): Controller Switching and Optimal State Selection.

- Harikrishnan Raghunathan (Dec. 2007): Observer techniques for nonlinear systems.

- Manikandan Ponnuswamy (Dec. 2005, with L. Iasemidis): Dynamical Analysis Of Epileptic Seizures Using Synchronization-Based Measures.

- C. Hornberg (Dec. 2004): Wafer Optimized Profile Temperature Control of a Semiconductor Diffusion Furnace

- T. Thrasyvoulou (Aug. 2003, with A. Spanias): Adaptive beamforming using a complex bounding ellipsoid algorithm with gradient projections.

- Aris Papadopoulos (Dec. 2002): Swinging up the inverted pendulum by energy adaptive proportional-integral-derivative control.

- Kaushik Bhatt (Dec. 2002): Performance Monitoring of Controllers.

- J. Kristof (May 2000, with T. Cale): Optimal programmed rate chemical vapor deposition of tungsten.

- J. Frigo (Dec. 1996): An analog neural network control method proposed for use in spacecraft systems.

- C. Alexander (May 1995): System modeling and control of an inverted pendulum: an input-output approach.

- K. Stoddard (Sep. 1994, with P. Crouch and M. Kozicki): Application of feedforward and adaptive feedback control to semiconductor device processing.

- C.C. Kok (May 93): Application of neural network in the control of an oxidation process.

- Y.N. Liao (May 1992): Constrained parameter estimation in model reference adaptive control.

- S. Limanond (Dec. 1991): Decentralized adaptive linear quadratic control for time-varying systems.