Resume

Yuri B. Shtessel

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CITIZENSHIP: USA

EDUCATION:

Ph.D. - (Electrical Engineering) - dissertation title ***"Multiple criteria optimal control problems in autonomous systems of electric power supply,"*** Department of Automation and Remote Control, the South Ural State University, Chelyabinsk, Russia, 1978.
MS - (Electrical Engineering) - thesis title ***"Optimization of parameters of automatic control systems interconnected through a common source of power supply,"*** Department of Automatic Controls, the South Ural State University, Chelyabinsk, Russia, 1971.

EMPLOYMENT:

2021-present	***Adjunct Professor,*** Ecole Centrale de Nantes, Nantes, France.
2020-present	***Distinguished Professor Emeritus***, Department of Electrical & Computer Engineering, the University of Alabama in Huntsville, Huntsville, AL USA
2015-2020	***Distinguished Professor***, Department of Electrical & Computer Engineering, the University of Alabama in Huntsville, Huntsville, AL USA
Fall 2006	**Professor,** ***Interim Chair***, Department of Electrical & Computer Engineering, the University of Alabama in Huntsville, Huntsville, AL USA
2002-2015	***Professor***, Department of Electrical & Computer Engineering, the University of Alabama in Huntsville, Huntsville, AL USA
1993-2002:	***Associate Professor***, Department of Electrical & Computer Engineering, the University of Alabama in Huntsville, Huntsville, AL USA
1991-1993:	***Adjunct Professor,*** Department of Electrical & Computer Engineering, and Department of Mathematics, the University of South Carolina, Columbia, SC.
1983-1991:	***Associate Professor***, ***Deputy Department Chair for Research,*** Department of Applied Mathematics, the South Ural State University, Chelyabinsk, Russia.
1981-1983:	***Associate Professor***, Department of Applied Mathematics, the South Ural State University, Chelyabinsk, Russia.
1979-1981:	***Assistant Professor***, Department of Applied Mathematics, the South Ural State University, Chelyabinsk, Russia.
1974-1979:	***Research Engineer,*** Department of Automation and Remote Control, the South Ural State University, Chelyabinsk, Russia.
1971-1974:	***Engineer***, the Research Institute of Electrical Drives, Chelyabinsk Branch, Chelyabinsk, Russia.

VISITING APPOINTMENTS:

2022 (October)	***Visiting Professor*****,** Department of Automatic-Robotics, Ecole Centrale de Nantes, France.
2021 (Sept-Oct)	***Visiting Professor*****,** Department of Automatic-Robotics, Ecole Centrale de Nantes, France.
2018 (June-July)	***Visiting Professor*****,** Department of Automatic-Robotics, Ecole Centrale de Nantes, France.
2017 (May-June)	***Visiting Professor*****,** ENSEA, Cergy-Pontoise, and Department of Automatic-Robotics, Ecole Centrale de Nantes, both France.
2016 (May)	***Visiting Professor*****,** Department of Applied Mathematics, Polytechnic University of Catalonia, Spain.
2016(June-July)	***Visiting Professor*****,** Department of Automatic-Robotics, Ecole Centrale de Nantes, France.
2015 (Sept-Nov)	***Visiting Professor*****,** Department of Electrical and Electronic Engineering, University of Cagliari, Italy.
2015 (August-Sept)	***Visiting Professor*****,** South East University of China, School of Automation, China.
2015 (May-June)	***Visiting Professor*****,** Department of Automatic-Robotics, Ecole Centrale de Nantes, France.
2014 (June-July)	***Visiting Professor*****,** Department of Automatic-Robotics, Ecole Centrale de Nantes, France.
2013 (May-June)	***Visiting Professor*****,** Centre for Systems, Dynamics and Control, School of Engineering, Mathematics and Physical Sciences, University of Exeter, UK
2012 (May-June)	***Visiting Professor*****,** Department of Automatic-Robotics, Ecole Centrale de Nantes, France.
2011 (June)	***Visiting Professor,*** Department of Engineering, University of Leicester, Leicester, UK.
2010 (May-June)	***Visiting Professor*****,** Department of Automatic-Robotics, Ecole Centrale de Nantes, France
2008 (November)	***Visiting Professor*****,** Department of Automatic Control, CINVESTAV-IPN, Mexico City, Mexico.
2008 (Aug-Sept)	***Visiting Research Fellow*****,** Department of Information Technology, Naval Postgraduate School, Monterey, CA.
2008 (May-June)	***Distinguished Visiting Fellow of the UK Royal Academy of Engineering****,* the University of Leicester, Leicester, UK.
2003 (May-August)	***Visiting Lady Davis Fellow,*** Department of Mechanical Engineering, *Technion* (Israel Institute of Technology), Haifa, Israel.
2002 (April-June)	***Visiting Professor*****,** Department of Automatic Control, CINVESTAV-IPN, Mexico City, Mexico.
2001 (Sept-Dec)	***Visiting Professor,*** Department of Applied Mathematics, the University of Sheffield, Sheffield, UK.
1999 - 2000	***Research Fellow*****,** NASA/Marshall Space Flight Center, AL Intergovernmental Personnel Act (IPA) Mobility Program
1999 (May-July)	***Research Fellow,*** NASA/Marshall Space Flight Center, AL NASA/ASEE Summer Faculty Fellowship Program.

1997 (May-June) ***Research Fellow***, Wright Laboratory, Wright-Patterson AFB, OH
AFOSR Summer Faculty Fellowship Program.
1997 (June-August) ***Research Fellow,*** NASA/Marshall Space Flight Center, AL
NASA/ASEE Summer Faculty Fellowship Program.
1994 (June-August) ***Research Fellow,*** Phillips Laboratory, Kirtland AFB, NM
AFOSR Summer Faculty Fellowship Program.

RESEARCH AND ENGINEERING EXPERIENCE:

CONTRIBUTION TO CONTROL SYSTEMS

Sliding Mode Control Theory. A robust solution of the MIMO nonlinear output tracking problem was obtained in sliding modes using the method of system center. A method of system center is developed to transform a nonlinear output tracking to a corresponding state-variable tracking problem. Breakthrough is achieved in nonminimum phase output tracking on traditional and higher order sliding modes in causal systems that is addressed using dynamic extension of the system center and a sliding manifold as a dynamic operator. New results on higher order sliding mode (HOSM) observers for nonminimum phase nonlinear systems have been obtained. Novel adaptive conventional and higher order sliding mode control algorithms that allow not overestimating the sliding mode control gains in systems with bounded disturbances and unknown bounds are developed. The concepts of practical relative degree, performance phase and gain margins are introduced for sliding mode control systems using frequency domain techniques. The novel hybrid impulsive-HOSM control and hybrid impulsive-HOSM control in reduced information environment was proposed.

Multiple Criteria Optimization Theory. A multiple criteria optimization problem is addressed via proposed principle of proportional damages (PPD). A norm of a difference between ideal and optimal values of the vector-performance criteria is minimized while the distribution of the losses (damages) of the performance criteria is under control. The PPD is applied to a multiple criteria LQR problem solution. A multiple criteria LQR problem solution is achieved in a linear form of state variables and is invariant to the norm, which is minimized.

Improved Inertial Measurement Unit Technology Based On Higher Order Sliding Mode Observers. The Inertial Measurement Units (IMUs) accuracy is improved by reconstructing the true acceleration and the true attitude rate input signals by employing the second order sliding mode observer (2-SMO) operating in concert with dynamic inversion, given in real time dynamically distorted measurement and the IMU dynamics. The body bending rate is estimated using reconstructed acceleration. Implementation of the proposed algorithms does not require any modification of the hardware of existing IMUs.

Stability Margins in Nonlinear Systems. A new insight into defining stability margins in a class of nonlinear time invariant (NLTI) systems, including Lur'e systems, and systems driven my sliding mode control (SMC), and their identification algorithms, is proposed. The Stability Margins are defined and their identification algorithms based on DF/HB, CC, LMI, Lyapunov, Disk and Vector margin techniques are developed. The practical stability margins in SMC systems are studied and

defined in terms of maximal acceptable (tolerant) limit cycle parameters that may occur in SMC systems affected by unmodeled (parasitic) dynamics.

Missile Interceptor Integrated Guidance and Control on Conventional and Higher Order Sliding Modes. Sliding mode control-based high accuracy robust integrated autopilot/guidance system is designed for an advanced hit-to-kill missile interceptor in a hostile (measurement noise and disturbance) environment. Higher-order sliding mode observers and differentiators with reduced sensitivity to measurement noise are employed for improving overall robustness of a flight control system. The designed integrated autopilot/guidance systems in traditional and second order sliding modes have been tested on a hit-to-kill accuracy interceptor with piezo-ceramic tendon control actuators, and on a dual thruster control interceptor via computer simulations. The study of robust hypersonic missile control is accomplished via HOSM control and observation techniques.

Hypersonic Missile Control on Adaptive Continuous Higher Order Sliding Modes. Hypersonic missile control in the terminal phase for maximum target penetration is addressed using continuous higher order sliding mode (AHOSM) control with adaptation. The AHOSM self-tuning controller is proposed and studied. The double-layer adaptive algorithm is based on equivalent control concepts and ensures non-overestimation of the control gain to help mitigating control chattering. Finite- and fixed- settling time differentiators that utilize HOSM observation algorithms facilitate the flight AHOSM controller. The proposed continuous AHOSM control is validated via simulations of a hypersonic missile in the terminal phase. The robustness and high accuracy output tracking in the presence of matched and unmatched external disturbances and missile model uncertainties is demonstrated.

Launch Vehicle Control on Classical and Higher Order Sliding Modes. Breakthrough is achieved in crew launch vehicle (CLV) and reusable launch vehicle (RLV) control in ascending, descending and terminal area energy management regions of flight using multiple-loop multiple time-scale time-varying sliding mode controller with reconfiguration and gain-direct adaptation. High accuracy robust trajectory tracking is achieved for the X-33 technology demonstration RLV and is assessed via 6DOF high fidelity simulation. The designed robust controllers permit RLV and CLV to operate in an aircraft-like regime without extensive preflight modeling and computations. Higher order sliding mode control autopilot is designed and studied for SLS-X launch vehicle (FALCON). Bending mode controller is designed using sliding mode disturbance observers for the Ares-1 launch vehicle. All designs are verified via computer simulations.

Flight Control of Damaged Aircraft on Multiple Time-Scaled Re-configurable Sliding Modes. The breakthrough is achieved in controlling damaged aircraft without traditional damage estimation and adaptation in a feedback loop. Aircraft damage recovery is achieved via robust de-coupling two/three loop multiple time-scale sliding mode controller with control reconfiguration. Robust, high-accuracy flight tracking performance is assessed via computer simulations of F-16 jet fighter and tailless aircraft (ICE Model) with re-configurable sliding mode controllers.

Sliding Mode Control of DC-to-DC and AC-to-DC power converters (buck, boost and buck-boost). The breakthrough has been achieved in decentralized de-coupling sliding mode control of the system of multiple modular DC-to-DC power converters, connected through a common primary source of electric power supply. Also, sliding mode control based on the methods of stable system center and dynamics sliding manifold was designed for boost and buck-boost (nonminimum phase)

converters that follow arbitrary output voltage command profiles. The sliding mode control was design for boost AC-to-DC 3-phase power converters with full bridge and Vienna power blocks. The power factor was improved up to 97%. Control systems' efficiency was validated via computer simulation and rapid prototyping.

Fuel-Cell-based Electric Power System Control Using Sliding Mode Control Techniques. Control of an autonomous electric power system that comprises Proton Exchange Membrane fuel cell (PEMFC), the DC-DC boost power converter, and the ultracapacitor is addressed using sliding mode control techniques. System's PEMFC/ultracapacitor/DC-DC boost power converter zero dynamics are analyzed and appeared to be stable. The adaptive gain super-twisting sliding mode controller controls the current in PEMFC. The decoupled SMCs are designed for robust controlling the output voltage and the fast component of the load current that is commanded to the ultracapacitor. Controlling the multiple modular configuration is under development. The efficacy and robustness of the proposed three-fold SMC and 2-SM adaptive-gain controllers are confirmed via computer simulations.

Blood Glucose Regulation via Higher Order Sliding Mode Control. The breakthrough has been achieved in using HOSM feedback control for the stabilization of the blood glucose concentration level in diabetic patients. Robustness to the external disturbances, including food intake and physical workout, as well as to the parameter variations of the model of a diabetic patient is provided. The insulin pump and sensor dynamics are taken into account. The efficiency of the studied HOSM controllers/observers has been confirmed via computer simulations using Bergman minimal model, Hovorka and Sorensen models.

Retaining connectivity for mobile wireless communication network. The problem of maintaining connectivity in a mobile communication network is addressed. The agents consist of two classes: one class of agents, which is termed primary mission agents, performs surveillance operations that may or may not be coordinated efforts. The second class of agents, which is termed relay agents, are controlled to maintain the connectivity. Two control algorithms are proposed to retain the connectivity of the network. Sliding mode observers are employed to predict the trajectories of the primary mission agents, when only their positions are known from blue force messages, and this information is used to construct state dependent graphs encapsulating the measure of connectivity. An optimal model predictive control is employed to develop the control policies for the relay agents to maximize connectivity. The hybrid system approach is used to retain the connectivity of the communication network. The efficacy of the proposed control algorithms is confirmed on a case study of Riverine detection and interdiction operation.

Tight Air Vehicle Formation Control Using Higher Order Sliding Modes. Novel robust, higher order, sliding mode control and observation techniques are used to design continuous/smooth control laws suitable for a formation-hold autopilot in the presence of unknown disturbances and vehicle uncertainties. Simulation of three unmanned quadrotor rotorcrafts in a triangular tight formation following a sinusoidal path is implemented. The formation-keeping controller stabilizes the given relative distance, nullifying the position error in finite of time. The simulations show outstanding robustness and accuracy of formation tracking.

Sliding Mode Control System for Space Nuclear Reactor TOPAZ II. Robust sliding mode controllers were designed for the space nuclear reactor TOPAZ II. High accuracy, robust tracking of

the thermal power profile and the load electric power profile was achieved in a start up and operating regimes. Control system's efficiency was confirmed via computer simulation.

Sliding Mode Control of Inertial Platforms. The sliding mode controllers were designed for a three-axis inertial platform stabilization system with dynamically tuned gyroscope sensors. High accuracy robust de-coupled stabilization of axes of the inertial platform was achieved in de-centralized sliding modes. Noise filtration was tailored to control system computer simulation and implementation.

RECENT SPONSORED RESEARCH (Principal Investigator):

- Contract "Resource Prospector Lunar Lander Off-Pulsing Control: Adaptive Sliding Mode Control Approach," NASA/MSFC, 08/15/18 – 08/14/19, award $ 49,588.
- *Grant* (Co-PI), *"*Sliding mode adaptive distributed control," United States - Israel Bi-national Science Foundation (BSF), 10/01/11 – 9/30/15, award $94,000.
- Contract "Higher Order Sliding Mode Guidance and Control of Hypersonic Missiles," Eglin Air Force Base, 08/27/12 – 05/27/13, award $28,960.
- *Contract* "Sliding Mode Controller for Ultra-high Efficiency Power Factor Correction (PFC)," Fairchild Controls Corporation, 06/18/2008 - 08/11/2011, award $170,000.
- *Grant* (Co-PI), *"*Adaptive Coordinated Control with VSS/SMC," United States - Israel Bi-national Science Foundation (BSF), 10/01/07 – 9/30/10, award $79,500.
- *Contract* "Launch vehicle bending modes control," NASA/TBE, 2/9/2009 - 9/30/2009, award $46,107.
- *Contract* "Control System Modeling and Simulation Support," NASA/TBE, 06/19/07 – 9/28/07, award $53,471.
- *Contract* "Sliding Mode Controller for Ultra-high Efficiency Power Factor Correction (PFC)," Fairchild Controls Corporation, 11/27/2006 - 12/31/2007, award $100,000.
- *Contract* "Active Compensation of Low Frequency Flexible Modes of Crewed Launch Vehicle," NASA/USRA, 04/12/06 – 10/12/06, award $54,583.
- *Contract* "Integrated Guidance and Control Technology for RLV Risk and Cost Reduction," NASA, Marshall Flight Space Center, AL, 06/1/01-09/30/03, award: $233,000.
- *Contract* "Sliding Mode Controller Design for Advanced Interceptors," U.S. Army Strategic Missile Defense Command, Huntsville, AL, 12/22/99-03/30/02, award: $80,000.
- *Grant* "Improved Reconfigurable Sliding Mode Controller for Reusable Launch Vehicle of Second Generation Addressing Aerodynamic Surface Failures and Thrust Deficiencies," NASA, Marshall Flight Space Center, AL, 12/01/00-11/30/01, award: $31,378.
- *Contract* "Smooth Sliding Mode Controller Design," U.S. Army Aviation and Missile Command, Huntsville, AL, 5/10/01 – 9/30/01, award: $22,481.
- *Contract* "Reusable Launch Vehicle Control in Sliding Modes," NASA, Marshall Flight Space Center, AL, 08/15/99-08/14/00, award: $87,754.
- *Contract* "Sliding Mode Control Design," U.S. Army Strategic Missile Defense Command, Huntsville, AL, 05/07/99-03/31/00, award: $20,000.
- *GSRP Grant* "Sliding Mode Control of Reusable Launch Vehicle Re-entry," NASA, Marshall Flight Space Center, AL, 08/24/97-08/23/98, award: $22,000.

- *Grant* "Continuous Sliding Mode Control Approach for Addressing Actuator Deflection and Deflection Rate Saturation in Tailless Aircraft Control and Re-configurable Flight Control," Air Force Office of Scientific Research, 01/01/98-12/31/98, award: $25,000.
- *Contract* "Investigation of Control System Technologies for Performance Improvement," U.S. Army Aviation and Missile Command, Huntsville, AL, 06/08/98-09/30/98, award: $19,961.
- *Contract* "Advanced Precision Aerial Delivery System," U.S. Army Missile Command, Huntsville, AL, 03/11/97 - 09/30/97, award $16,978.

SERVICE TO DISCIPLINE

PROFESSIONAL ACTIVITIES:

- Associate Fellow of American Institute of Aeronautics and Astronautics (AIAA)
- Senior Member of Institute of Electrical and Electronics Engineers (IEEE)
- Guest editor (altogether with F. Plestan and L. Fridman) of Special Issue on "Adaptive Sliding Mode Control and Observation," *International Journal of Control,* Vol. 89, Issue 9, 2016
- Guest editor (altogether with C. Tournes and L. Fridman) of Special Issue on "Advances in Guidance and Control of Aerospace Vehicles using Sliding Mode Control and Observation Techniques" of *The Journal of the Franklin Institute*, Vol. 349, Issue 2, March 2012.
- Guest editor (altogether with M. Basin) of Special Issue on "Advances in Nonlinear Observation and Identification for Dynamic Systems" of *The Journal of the Franklin Institute*, Vol. 347, Issue 6, August 2010.
- Guest editor (altogether with L. Fridman and A. Zinober) of Special Issue on "Advances in Higher Order Sliding Mode Control" of *International Journal of Robust and Nonlinear Control*, Vol. 18, Issue 4-5, 2008.
- Guest editor (altogether with S. Spurgeon and L. Fridman) of Special Issue on "Advances in Sliding Mode Observation and Estimation" of *International Journal of Systems Science*, Vol. 38, Issues 11 and 12, 2007.
- Subject Editor, *The Journal of the Franklin Institute*
- Technical Editor*, IEEE Transactions on Mechatronics* (2016-2022)
- Associate Editor, *IEEE Transactions on Aerospace and Electronic Systems*
- Member of the *IEEE Variable Structure Systems Technical Committee*.
- Member of the *Conference Editorial Board*, the IEEE Control Systems Society
- Member of the Program Committee, the American Control Conference, 2002; the Variable Structure System Workshop, 2014, 2016, 2018.
- Chairman of the IEEE Control Systems Society, Huntsville Section (1997 – 1999)
- Chair/co-chair of sessions at the
  Conferences on Decision and Control (Orlando, FL, 2011, Atlanta, GA, 2010; Seville, Spain, 2005; Las Vegas, NE, 2002; Phoenix, AZ, 1999, and Tampa, FL, 1998).
  American Control Conference (Atlanta, GA, 2022, Philadelphia, PA, 2019; Boston, MA, 2016; Washington, DC, 2013; Montreal, Canada, 2012; Baltimore, MD, 2010; Saint Louis, MO, 2009; New York, NY, 2007; Portland, OR, 2005; Washington, DC, 2001; Philadelphia, PA, 1998).
  AIAA Guidance, Navigation and Control Conference (Portland, OR, 2011; Toronto, Canada, 2010; Hilton Head, SC, 2007; Montreal, Canada, 2001).

- Organizer/co-organizer and Chair/co-chair of invited sessions
  "Sliding Mode Control with Adaptation," at IFAC World Congress, Milan, Italy, 2011.
  "Advances in Higher Order Sliding Mode Observation and Estimation", "Advances in High Order Sliding Mode Control", and "Applications of Higher Order Sliding Mode Control" at IFAC World Congress, Seoul, Korea, 2008.
  "Advances in High Order Sliding Mode Control," at IFAC World Congress, Prague, Czech Republic, 2005.
  "Advances in High Order Sliding Modes," at the *Conferences on Decision and Control,* Hawaii, 2003.
- Co-organizer and co-chair of a mini-symposium "Sliding Mode Control of Large Scale Systems" at the 3^{d} SIAM Conference on Control and Its Applications, St. Louis, MO, 1995.
- Reviewer of a variety of professional journals, including *IFAC Automatica,* the *IEEE Transactions on Automatic Control; Control Systems Technology*; *Industrial Electronics,* the *AIAA Journal on Guidance, Control, and Dynamics*, and the *Journal of the Franklin Institute.*

SELECTED INVITED PRESENTATIONS:

1. Variable Structure Systems Workshop, "Sliding mode control and observation in aerospace systems," Graz, Austria, July 2018.
2. ENSEA, Cergy, France, "Causal Nonminimum Phase Output Tracking in in Sliding Modes," June 2017.
3. Polytechnic University of Catalonia, Spain, "Nonminimum Phase Output Tracking in in Sliding Modes," May 2016.
4. University of Cagliari, Italy, "Flexible modes control via fault estimation: ARES I application," October 2015.
5. Technion, Israel, "Output Tracking in Nonminimum Phase Systems in Sliding Modes," July 2015.
6. South East University of China, China:
   - "Adaptive Sliding Mode Control," September 2015.
   - "Nonminimum Phase output tracking on Sliding Modes," September 2015.
7. UNAM, Mexico City, Mexico, "Hybrid-Impulsive second order sliding mode control," August 2014.
8. Technion, Israel, "Air-Breathing Hypersonic Missile Continuous Higher Order Sliding Mode Control for Maximum Target Penetration," June 2014.
9. Technion, Israel, "Presentation of the book "Sliding Mode Control and Observation", May 2013.
10. Technion, Israel, "Adaptive Sliding Mode Control", May 2012.
11. UNAM, Mexico City, Mexico, "PEM Fuel Cell/DC-DC Boost Powers Converter System Control via Sliding Modes," May 2011.
12. Ecole Centrale de Nantes, France, June 2010
    - "Reconfiguration of a Mobile Communication Network via Higher Order Sliding Mode Control"
    - "Second Order Sliding Modes and Finite Reaching Time Adaptive Nonlinear Control"
    - "Sliding Mode Observers with Application to Flexible Mode Control for Ares I"
13. ICEECSAS-2008, Mexico City, Mexico, "Sliding Mode Control: Theory and Applications: Tutorial," November 2008.

14. UNAM, Mexico City, Mexico, "Active Compensation of Low Frequency Flexible Modes of Crew Launch Vehicle Using Sliding Mode Observers," November 2008.
15. Workshop at CDC, Cancun, Mexico, "Homogeneous Higher-Order Sliding Mode Control: Aerospace control systems" December 2008.
16. Naval Postgraduate School, Monterey, CA, "Aerospace Vehicle Control Using Higher Order Sliding Modes," August 2008.
17. Department of Mechanical Engineering Seminar, University of Bristol, UK, "Closed-Coupled Formation Flight Control Using Higher Order Sliding Modes," June 2008.
18. "Higher Order Sliding Mode Control with Application to Blood Glucose Level Regulation" at
    - Department of Civil Engineering Seminar, Technion, Haifa, Israel, March 2008.
    - IMA Systems and Control Theory Group Seminar, London City University, UK, May 2008.
    - Department of Applied Mathematics Seminar, University of Sheffield, UK, June 2008.
19. Naval Postgraduate School, Monterey, CA, "UAV formation, Reusable Launch Vehicle and Missile Control via Traditional and High Order Sliding Modes," August 2005.
20. "Sliding Mode Control: Overview and Applications to Aerospace Control,"
    - Department of Mechanical Engineering Seminar, Technion – Israel Institute of Technology, Haifa, Israel, June 2003.
    - Department of Automatic Control Seminar, Centro de Investigacion y de Estudios Avanzados del I.P.N (CINVESTAV-IPN), Mexico City, Mexico, May 2002.
    - Department of Engineering Seminar, Cambridge University, UK, November 2001.
    - Department of Electrical Engineering Seminar, University of Liverpool, UK, November 2001.
    - Department of Applied Mathematics Seminar, University of Sheffield, UK, October 2001.
21. Leicester University, UK, "Advances in Sliding Mode Control," November 2001.
22. Invited Session, *Conference on Decision and Control*, Orlando, FL, "Analog-to-Digital Converters: Sliding Mode Observer as a Pulse Modulator," December 2001.
23. "Integrated Guidance and Control System Design For Hit-to-Kill Interceptors: Sliding Mode Approach,"
    - RAFAEL (state-run missile company), Haifa, Israel, July 2003.
    - Naval Postgraduate School, Monterey, CA, May 2008.
24. XXII Congresso Internacional de Ingenieria Electronica, Chihuahua, Mexico "Nonminimum Phase Tracking on Sliding Modes," October 2000.
25. IEEE CSS Meeting, Huntsville, AL, "Sliding Mode Control: Theory and Applications (Tutorial)," March 2000.
26. Boeing (DoD Program), Huntsville, AL, "Sliding Mode Control: Application to Controller Design for Kinetic Energy Kill Vehicle," February 1999.
27. US Army Missile Command (Guidance and Control Systems Division), Huntsville, AL, "Sliding Mode Control Technique: Theory and Application to Missile Control" January 1995.
28. NASA/MSFC (Guidance and Control Systems Division), Huntsville, AL, "Launch Vehicle Control on Sliding Modes," February 1994.
29. US Army Missile Command (Propulsion Division) Huntsville, AL, "Sliding Mode Control Technique: Theory and Application to Propulsion Control," February 1994.

30. IEEE CSS Meeting, Huntsville, "Sliding Mode Stabilization of Three-Axis Inertial Platform," November 1993.

AWARDS:

- A recipient of AIAA Small Satellite Best Paper Award from the AIAA Scitech 2021 Forum for the paper "Adaptive Double-Layer Continuous Super-Twisting Control of a Satellite Formation" (AIAA-2021-0560) by Mason Nixon and Yuri Shtessel.
- A recipient of the Harold Chestnut Control Engineering Textbook Prize for a textbook *Sliding Mode Control and Observation*, Springer 2014 by Y. Shtessel, C. Edwards, L. Fridman, and A. Levant, 2020.
- A recipient of the UAH College of Engineering Outstanding Senior Professor Award, 2013.
- A recipient of Distinguished Visiting Fellowship of the Royal Academy of Engineering, UK, 2008.
- A recipient of the UAH Research and Creative Achievement Award, 2004.
- A recipient of the IEEE Third Millennium Medal for the outstanding contribution to control systems engineering, 2000.
- A recipient of the IEEE Certificate of Recognition for the valued service and contribution made as a chair of Control System Society, Huntsville Section, 1997-1999.
- A recipient of the IEEE Huntsville Section Outstanding Educator Award, 1999.
- A recipient of the IEEE Huntsville Section Outstanding Service Award, 1998.
- A recipient of the Certificate of Recognition for research contribution made through the NASA/ASEE Summer Faculty Fellowship Program, 1997.
- A recipient of the outstanding session presentation awards at 2003 Guidance, Navigation and Control Conference, and at 1997, 1995 American Control Conferences.

RECENT CONSULTIG SERVICE

- Boeing, Huntsville, AL, "Sensor Improvement," 04/30/2022-present
- Aero Thermo Technology, Inc., Huntsville, AL, "Fast IMU Autonomous Alignment, Gyroscopic and Accelerometer Measurement Improvement by Input Reconstruction," 01/01/2017-03/01/2021.
- Davidson Technologies, Inc., Huntsville, AL, "Missile and Satellite Guidance and Control," 06/01/2005-06/01/2014.
- IST-Rolla, Rolla, MO, "Integrated Missile Interceptor Guidance and Control," 05/15/2006-10/30/2006.
- Radiance Technologies, Inc., Huntsville, AL, "Missile Interceptor Guidance and Control," 02/01/2003-09/30/2005.
- KT Engineering, Huntsville, AL, "Ballistic Missile Control," 01/01/2004-05/31/2004.

LIST OF PUBLICATIONS

Publish or Perish: **Citations: 16373, h_{index}: 53, g_{index}: 119, $h_{I\text{-}norm}$: 35, $h_{I\text{-}annual}$: 1.06**
***Google scholar*:** **Citations: 16189, h_{index}: 53, $i_{10\text{-}index}$: 190**
***Scopus*:** **Citations: 12330, h_{index}: 46**

I. Books

1. Y. Shtessel, C. Edwards, L. Fridman, and A. Levant, *Sliding Mode Control and Observation*, Birkhauser, Springer, New York, 371 pages, 2014.

II. Peer-reviewed journal articles

Siddharth Das, Yuri Shtessel, and Franck Plestan, "Stability Margins Analysis for a Class of Nonlinear Systems: Disk and Vector Margins Approach," *International Journal of Control,* 2023 – under preparation.

2. R. Jesionowski, Y. Shtessel, and F. Plestan, "Sliding Mode Control Design Using Generalized Relative Degree Approach: Aerospace Application," *The Journal of the Franklin Institute*, Volume 360, Issue 14, 2023, pp. 10605-10632, https://doi.org/10.1016/j.jfranklin.2023.08.002.
3. S. Rouquet, M. Ghanes, J. -P. Barbot, Y. B. Shtessel and L. Merienne, "A Batteryless Series Hybrid Electric Vehicle Control," in *IEEE Transactions on Control Systems Technology*, vol. 31, no. 3, pp. 1032-1041, May 2023, doi: 10.1109/TCST.2022.3215256.
4. S. Nateghi, Y. Shtessel, C. Edwards, and J-P. Barbot, "Resilient Control of Cyber-Physical Systems Using Adaptive Super-Twisting Observer," *Asian Journal of Control*, Vol. 23, Issue 3, May 2023, pp 1775–1790, http://doi.org/10.1002/asjc.2922.
5. L. Chen, C. Edwards, H. Alwi, M. Sato, S. Nateghi, and Y. Shtessel "Sliding Mode Observers for Robust Fault Estimation in LPV Systems," *International Journal on Robust and Nonlinear Control*, Vol. 33, Issue 15, pp. 9084-9108, October 2023, https://doi.org/10.1002/rnc.6307.
6. S. Kode, Y. Shtessel, A. Levant, J. Rakoczy, M. Hannan, and J. Orr, "Development of Relative Degree Based Aerospace Sliding Mode Control MATLAB Toolbox with Cases Study", *IEEE Aerospace and Electronic Systems Magazine*, 2023, doi: 10.1109/MAES.2022.3177576 – published on-line.
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V. Papers and abstracts published in proceedings from scholarly meetings

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422. Y. Shtessel and C. Tournes, "Decentralized Sliding Mode Control in Integrated Flight Control Problem", *The Third SIAM Conference on Control and Its Applications*, April 27-29, St. Louis, MO, p. A42, 1995.
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437. O. Kazmin, B. Yakovlev, V. Efimov and Y. Shtessel, "Some Results of Numerical – Analog – Natural Modeling," *Proceedings of the All-Soviet Union Seminar on Applications and Development of Semi – Natural Modeling in Electric Power Engineering*, Irkutsk, Russia, pp. 37-41, 1979. [in Russian]
438. O. Kazmin and Y. Shtessel, "Design of Electronic Control Algorithms in Technical Basis," *Proceedings of the Beloruss Republic Conference on Technical Improvement of Design Algorithms, Production and Implementation of Radio Techniques, Electronic and Communication Tools*, Minsk, Beloruss Republic, pp. 79-80, 1979. [in Russian]
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VI. Student's Manuals

441. A. Komirev, B. Pelzwerger, and Y. Shtessel, *Modern and Optimal Control in Dynamic Systems. Student's manual for the design project*, South Ural State University, Chelyabinsk, Russia, 25 p., 1989. [in Russian]
442. R. Verkhogliad, N. Komar, and Y. Shtessel, *Numerical Methods for Computer Programming. Student's manual,* Vol. 2, South Ural State University, Chelyabinsk, Russia, 54 p. 1988. [in Russian]
443. R. Verkhogliad, N. Komar, and Y. Shtessel, *Numerical Methods for Computer Programming, Student's manual,* Vol. 1, South Ural State University, Chelyabinsk, Russia, 84 p., 1988. [in Russian]
444. R. Verkhogliad, and Y. Shtessel, *Computer Methods in Engineering. Student's manual for the laboratory practice*, South Ural State University, Chelyabinsk, Russia, 39 p., 1984. [in Russian]

445. R. Verkhogliad, and Y. Shtessel, *Computer Methods in Engineering. Student's manual for FORTRAN-programming*, South Ural State University, Chelyabinsk, Russia, 83 p., 1984. [in Russian]
446. L. Kazarinov, Y. Shtessel, and B. Yakovlev, *Design of Automatic and Remote Control Systems. Student's manual,* Vol. 3, South Ural State University, Chelyabinsk, Russia, 91 p., 1980. [in Russian]

VII. Patents

447. M.A.E. Alali, Y. Shtessel, and J-P. Barbot, ″Optimal energy management of smart grids: active photovoltaic compensator of smart energy-plus buildings, EP Patent PCT 067779, 2019.
448. C. Tournes and Y. Shtessel, "System and Method for Guiding and Controlling a Missile Using High Order Sliding Mode Control," *Patent of USA*: # 12/501,395, May 7, 2013.
449. L. Ozerov, O. Raznopolov, and Y. Shtessel, "Controller for the Multi-Channel System of Electric Power Supply," *Author's Certificate of Invention in the USSR,* No. 1624428 (SU 1624428 A1), October 1, 1990. [in Russian]
450. L. Ozerov, O. Raznopolov, Terentjev, N. E., and Y. Shtessel, "Pulse Stabilizer of DC Voltage", *Author's Certificate of Invention in the USSR*, No. 1571561 (SU 1571561 A1), February 15, 1990. [in Russian]
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INSTITUTIONAL SERVICE

Committee	Level	Years	Role
Faculty senate	UAH	2016-2018	Member
Faculty Appeals Committee	College of Engineering	2007-2008	Member, Consider appeals of faculty of College of Engineering
Promotion and Tenure Advisory Committee	College of Engineering	2003-2005, 2012-2017	Member. Considered applications of faculty of College of Engineering for tenure and promotion
Signals and Systems	ECE Department	1993-2019	Member and Chair. Provide leadership in the Signals and Systems Program curriculum development
EE Program Undergraduate/Graduate Affairs	ECE Department	1999-2019t	Member. Participate in undergraduate graduate program curriculum development
Graduate Affairs	ECE Department	1993-1997,	Member/Chair Participated in graduate program curriculum development

		2015-2019	
Faculty search committee	ECE Department	2018-2019	Chair
Research Affairs	College of Engineering	1994-1997	Member. Participated in developing perspective research directions
University Senate Governance Committee	University	1996-1997	Member. Participated in reviewing and updating the documents regulating the university faculty duties.
Undergraduate Affairs	ECE Department	1997-1999	Member and Chair. Provided leadership in developing mixed Electrical Engineering/Computer Engineering and Electrical Engineering/Optical Engineering programs curricula.
Space and Facilities	College of Engineering	1997-1998	Member. Participated in inspecting facilities and space available and developing recommendations for improvement
Shop	College of Engineering	1998-1999	Chair. Provided leadership in inspecting the College Shops and developing recommendations for improvement

TEACHING

COURSES TAUGHT

Remark. Courses, which were taught in The University of South Carolina, Columbia, SC [USC] and the South Ural State University, Chelyabinsk, Russia [RUS], are given catalog numbers of similar courses offered in UAH.

EE-722	*Sliding Mode Control: Theory and Applications* [UAH, graduate]
EE-704	*Nonlinear Control Systems* [UAH, graduate]
EE-701	*Advanced Linear Control Theory* [UAH, graduate]
EE-629	*Analytical & Computational Methods in Electrical Engineering* [UAH, graduate]
EE-607	*Robotic Systems Control* [UAH, graduate]
EE-605	*Classical Controller Design* [UAH, graduate]
EE-486/586	*Introduction to Modern Control Systems* [UAH, graduate/undergraduate][#]
EE-386	*Introduction to Control and Robotic Systems* [UAH, undergraduate]
EE-425/505	*Introduction to Control and Robotic Systems* [UAH, undergraduate/graduate]
EE-494	*Digital Signal Processing Senior Design Project* [UAH, undergraduate]
EE-382	*Analytical Methods for Continuous Time Systems* [UAH, undergraduate]
EE-213/300	*Electrical Circuits I* [UAH, undergraduate]
EE-202	*Introduction to Digital Logic Design* [USC, undergraduate]
MA-324	*Introduction to Differential Equations* [USC, undergraduate]

MA-105 *College Algebra* [USC, undergraduate]
EE-705 *Theory of Optimal Control* [RUS, graduate]
ISE-626 *Introduction to Operation Research* [RUS, graduate]
CPE-112 *Introduction to Computer Programming in Engineering* [RUS, undergraduate]

CURRICULUM DEVELOPMENT

1. A new graduate course EE-722, "Sliding Mode Control" is developed. This course also was taught in the spring semesters of 1996-2005 academic years numbered as EE-710 "Selected Topics in Electrical Engineering".
2. Provided leadership in "Remote Access Control and Dynamic System Laboratory" development. The laboratory development was supported by NSF grant "Virtual Control and Dynamic Systems Laboratory Development", terms 01/10/00 – 01/09/03, The NSF award, $52,901, was matched by the UAH funds.
   PI: **Dr. Shtessel,** Co-Pi: Dr. Hampton, Dr. Johnson, Dr. Frederick, Mr. Middleton.

RECENT STUDENT ADVISEMENT

1. The following graduate students completed the PhD programs at UAH:

Name	Topic of Dissertation	Time of Graduation
Ilya A. Shkolnikov	Output Tracking in Causal Nonminimum Phase Nonlinear Systems in Sliding Modes	2001
Mark D. J. Brown	Continuous and Smooth Sliding Mode Control	2001
Donald R. Krupp, Jr.	Dynamic Sliding Manifold-based Control in Systems with Unmodeled Cascade Dynamics	2004
Dalton S. Nelson	Intelligent Control of Patient-Ventilator Synchrony	2007
Damien Galzi	Tight Air Vehicle Formation Control Using Higher Order Sliding Modes	2007
Parisa Kaveh	Blood Glucose Regulation Via Higher Order Sliding Mode Control	2007
Simon S. Baev	Output Feedback Tracking in Causal Nonminimum Phase Nonlinear Systems in Higher Order Sliding Modes	2008
James Stott	Classical and Higher Order Sliding Mode Control for Launch Vehicle Systems	2009
Jose Kochalummoottil	Adaptive second order sliding mode control	2012
Roshini Ashok	Control of Fuel Cell Electric Power Systems Using Sliding Mode Control & Observation Techniques	2015
Chandrasekhara Bharath Panathula	Certifiable Higher Order Sliding Mode Control: Practical Stability Margins Approach	2016
Fathi Aldukali	Hybrid Impulsive Higher Order Sliding Mode Control	2019

Shamila Nateghiboroujeni	Attack Reconstruction and Secure State Estimation in Cyber-Physical Systems Using Sliding Mode Observers	2020
Michael Cross	Missile Interceptor Integrated Guidance and Control: Single-loop Higher-order Sliding Mode Approach	2020
Mohammed Alfayizi	Quad-rotor Adaptive Sliding Mode Control Using Only Position and Yaw Sensors: Generalized Relative Degree Approach	2021
Sebastien Rouquet	Optimized energy management for series hybrid electric vehicles	2021
Sai Kode	Development of aerospace sliding mode control toolbox: relative degree approach with resource prospector lander and launch vehicle case studies	2022
R. J. Rajesh	Accuracy Improvement of Dynamic Sensors Measured Input Reconstruction Using Sliding Mode Observers	2022
Siddharth Das	Study of Stability Margins for a Class of Nonlinear Systems	2022
Mason Nixon	Adaptive Sliding Mode Control of Small Satellites in Formation for Distributed Beamforming Applications	2022

2. The following graduate students completed the MS programs with thesis at UAH:

Name	Thesis Title	Time of Graduation
Mark E. Jackson	Sliding Mode Thermal Control System for Space Station Furnace Facility	1995
Lee Joung-Ju	Performance Comparison of the Feedback Linearization Control and Sliding Mode Control for a Permanent Magnet Stepper Motor	1996
Christian H. Tournes	Aircraft Control in Sliding Modes	1996
James H. McDuffie	Sliding Mode Control of Spacecraft Attitude	1997
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