

Taylan G. Topcu

ASSISTANT PROFESSOR · GRADO DEPARTMENT OF INDUSTRIAL & SYSTEMS ENGINEERING · VIRGINIA TECH

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Education

Virginia Tech

Blacksburg, VA

PHD IN INDUSTRIAL AND SYSTEMS ENGINEERING

2016 - 2020

- Dissertation: Management of Complex Sociotechnical Systems
- Committee: Dr. Konstantinos "Kostas" Triantis (Chair), N. Ghaffarzadegan, A. Salado, P. Collopy, and B. Roets

The University of Alabama in Huntsville (UAH)

Huntsville, AL

MS IN SYSTEMS ENGINEERING

2014 - 2015

- Thesis: Impact of Multiple Stakeholder Preferences on Design
- Committee: Dr. Bryan Mesmer (Chair), P. Collopy, and P. Farrington

Middle East Technical University (METU)

Ankara, Turkey

BS IN AEROSPACE ENGINEERING

2005 - 2009

Professional Experience

Assistant Professor of Systems Engineering, Department of Industrial and Systems Engineering, Virginia Tech

- 2022 -
- Research on socio-technical measurement issues in complex systems design and management of safety-critical systems. | Coordinator of the Mission Engineering Certificate Program

Postdoctoral Scientist, Department of EMSE, the George Washington University

- 2020 - 2022
- Supervised by Prof. Zoe Szajnarfarber | Research in Decomposition Theory & Leveraging Open Innovation for Design of Engineered Systems, wrote awarded research proposals, mentored students, and lectured.

Instructor of Record, Department of Industrial and Systems Engineering, Virginia Tech

- 2020
- Co-Instructed Systems Engineering Capstone Course for Masters' level students.

Graduate Assistant, Department of Industrial and Systems Engineering, Virginia Tech

- 2016-2020
- Supervised by Prof. Kostas Triantis | Research in extending the micro-economic production theory for management of sociotechnical & safety-critical systems, assisted with writing research proposals and teaching.

Graduate Research Assistant, Department of ISEEM, the University of Alabama in Huntsville

- 2014-2015
- Supervised by Dr. Bryan Mesmer and Prof. Paul Collopy | Research in decision-based design, multi-disciplinary design optimization, and formulation of stakeholder value functions. 2015 ISEEM Grad Student of the Year.

Systems Engineer, Tactical Missile Systems Division, ROKETSAN Missile Industries

- 2010-2014
- Systems Architect on HISAR Program (first domestic air defense missile system of Turkey) | Expertise in defining use-cases & requirements, safety analysis, framing statement of work documents & contracting.

Publications

**mentored graduate student*

REFEREED JOURNAL ARTICLES

- J7. Szajnarfarber, Z., **Topcu, T.G.**, and Lifshitz-Assaf, H. "Towards a Solver-Aware Systems Architecting Framework: Leveraging Experts, Specialists and the Crowd to Design Innovative Complex Systems" *Design Science* 8, E10. doi:10.1017/dsj.2022.9
- J6. **Topcu, T.G.** and Triantis, K. (2021) "An Ex-Ante Data Envelopment Analysis Method for Representing Contextual Uncertainties and Stakeholder Risk Preferences." *Annals of Operations Research*, 309, 395–423 (2022).
<https://doi.org/10.1007/s10479-021-04271-1>

- J5. Hennig, A*, **Topcu, T.G.**, and Szajnarfarber, Z. (2021) “So You Think Your System Is Complex?: Why and How Existing Complexity Measures Rarely Agree.” *ASME Journal of Mechanical Design*, April 2022; 144(4): 041401. <https://doi.org/10.1115/1.4052701>
- J4. **Topcu, T.G.**, Mukherjee, S., Hennig, A*, and Szajnarfarber, Z. (2021) “The Dark Side of Modularity: How Decomposing Problems can Increase System Complexity.” *ASME Journal of Mechanical Design*, March 2022; 144(3): 031403. <https://doi.org/10.1115/1.4052391>
- J3. **Topcu, T.G.**, Triantis, K., Malak, R., and Collopy, P. (2020) “An Interdisciplinary Strategy to Advance Systems Engineering Theory: The Case of Abstraction and Elaboration.” *Systems Engineering*, 23 (6): 673–83. <https://doi.org/10.1002/sys.21556>.
- J2. **Topcu, T.G.**, Triantis, K., and Roets B. (2019) “Estimation of the Workload Boundary in Socio-Technical Infrastructure Management Systems: The Case of Belgian Railroads.” *European Journal of Operational Research*, 278 (1): 314–29. <https://doi.org/10.1016/j.ejor.2019.04.009>.
- J1. **Topcu, T.G.** and Mesmer B.L. (2018) “Incorporating End-User Models and Associated Uncertainties to Investigate Multiple Stakeholder Preferences in System Design.” *Research in Engineering Design*, 29 (3): 411–31. <https://doi.org/10.1007/s00163-017-0276-1>.

JOURNAL ARTICLES UNDER REVIEW

- U3. **Topcu, T.G.**, Zhang, L*, and Szajnarfarber, Z. ”Does Open Innovation Open Doors for Underrepresented Groups to Contribute to Technology Innovation?: Evidence from a Space Robotics Challenge” *Space Policy*, Second Round of Review as of 7/31/2022.
- U2. **Topcu, T.G.**, and Szajnarfarber, Z. “Navigating Cost, Schedule, and Performance Trade-offs through Co-Design of Modules and Interfaces” *ASME Journal of Mechanical Design*, Under Review as of 6/17/2022.
- U1. Madsen, P., Dillon, R., Triantis, K., Roets, B., and **Topcu, T.G.** “Ghost in the machine? Organizational moderators of automated decision-making systems’ ability to prevent organizational errors.” *Journal of Management Studies*, Submitted on 6/02/2021.

REFEREED ARTICLES IN CONFERENCE PROCEEDINGS

- C7. **Topcu, T.G.**, and Szajnarfarber, Z. “The Need to Simultaneously Consider Modularization and Interface Design during Systems Architecting: an Exploration of their Joint Impact on System Performance and Cost” *Complex Systems Design & Management (CSDM) Conference Paris 2022*, Accepted for Publication as of 8/03/2022.
- C6. **Topcu, T.G.**, Triantis, K., and Roets B. (2022). ”Identification of Adverse Operational Conditions in Sociotechnical Systems: A Data Analytics Approach.” In: *Recent Trends and Advances in Model Based Systems Engineering*, Springer, Cham. https://doi.org/10.1007/978-3-030-82083-1_12
- C5. Madsen, P., Dillon, R., Triantis, K., Roets, B., and **Topcu, T.G.** (2021) “Organizational moderators of the effect of autonomous technology on organizational error prevention.” *Academy of Management Proceedings*, 2021 (1), 0065-0668
- C4. Hennig, A*, **Topcu, T.G.**, and Szajnarfarber, Z. (2021) “Complexity Should Not Be In the Eye of the Beholder: How Representative Complexity Measures Respond to the Commonly-Held Beliefs of the Literature” *Proceedings of the ASME 2021 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, Volume 6: 33rd International Conference on Design Theory and Methodology (DTM). Virtual, Online. August 17–19, 2021 . <https://doi.org/10.1115/DETC2021-69598>.
- C3. Mukherjee, S., Hennig, A*, **Topcu, T.G.**, and Szajnarfarber, Z. (2021) “When Decomposition Increases Complexity: How Decomposing Introduces New Information into the Problem Space.” *Proceedings of the ASME 2021 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. Volume 6: 33rd International Conference on Design Theory and Methodology (DTM). Virtual, Online. August 17–19, 2021. <https://doi.org/10.1115/DETC2021-71917>
- C2. Dillon, R., Madsen, P., Roets, B., **Topcu, T.G.**, and Triantis, K. (2020) “The Autonomous Decision System Choice.” *20th Annual Workshop on the Economics of Information Security (WEIS)*, Brussels, Belgium
- C1. **Topcu, T.G.** and Mesmer B.L. (2015) Customer, Commercial, and Government Value Functions for Electric Vehicle System Design.” *IIE Annual Conference Proceedings*, (2015): 959-968

External Research Grants _____

FUNDED RESEARCH GRANTS AS PI OR CO-PI

- 2021 **Collaborative Research: Theory-Grounded Guidelines for Solver-Aware System Architecting (SASA)**, *National Science Foundation CMMI EDSE #2129574* \$ 520,000
PI: Panchal, J. (Purdue), Co-PI: Szajnfarber Z., & **Co-PI: Topcu T.G.**

FUNDED RESEARCH GRANTS AS GRADUATE STUDENT

- 2021 **LEAP-HI: Safety and Learning from Errors and Near Misses in the Human-Automation Interaction of Socio-Technical Infrastructure Systems**, *funded by National Science Foundation LEAP-HI Program #2051685* - this proposal originated from my dissertation. \$2,000,000
PI: Triantis K., Co-PI: Dillon-Merril, R. (Georgetown), Co-PI: Madsen, P. (BYU), Co-PI: Srinivasan, D. (Clemson)

Honors & Awards

- 2020 **VT ISE Senior Design Competition - Digital Innovation Award**, as a co-advisor
2017 - 2019 **Travel Grants**, Virginia Tech ISE \$ 6,000
2015 **Graduate Student of the Year**, the University of Alabama in Huntsville, ISEEM Department
2013 **Role Model of the Year**, Middle East Technical University "Falcons" Football
2010 - 2013 **National Athlete**, Turkish National American Football Team

Presentations

INVITED TALKS

Towards a Sociotechnical Theory for Architecting Complex Systems

- Spring 2022 Industrial & Enterprise Systems Engineering, the University of Illinois at Urbana-Champaign
Spring 2022 The Grado Department of Industrial & Systems Engineering, Virginia Tech
Fall 2021 The Department of Electrical Engineering and Computer Science, Embry-Riddle Aeronautical University
Fall 2021 Talktopus Seminar Series, Vermont Complex Systems, the University of Vermont
Fall 2021 Prof. Christopher McComb's Research Group, Department of Mechanical Engineering, Carnegie Mellon University
Fall 2021 Data Driven Innovation Lab, Engineering Product Design, Singapore University of Technology and Design (SUTD)
Summer 2021 Mesmer Research Group, Department of Industrial & Systems Engineering, and Engineering Management, the University of Alabama in Huntsville (UAH)

Performance Measurement in Complex Sociotechnical Systems

- Fall 2019 Department of Engineering Management and Systems Engineering, the George Washington University

GUEST LECTURE

Value Driven-Design

- Spring 2017 ISE 5124 Management of Quality and Reliability, Grado Department of Industrial and Systems Engineering, Virginia Tech.

CONFERENCE PRESENTATIONS **mentored graduate student*

- Fall 2021 "Does Open Innovation Enable STEM Agencies to Achieve Their Diversity Policy Objectives?", *Eighth International Engineering Systems Symposium (CESUN 2021)*, Charlottesville, VA
Summer 2021 "When Decomposition Increases Complexity: How Decomposing Introduces New Information into the Problem Space", *ASME IDETC/CIE 2021*
Summer 2021 Anthony Hennig* "So, You Think Your System Is Complex? How Representative Complexity Measures Respond To The Commonly-Held Beliefs Of The Literature", *ASME IDETC/CIE 2021*

Summer 2021 Saman Mohsenirad*, "A Methodological Framework to Incorporate Social Survey Data in DEA: The Case of Household Performance in Hurricane Evacuation", *North American Productivity Workshop 2021*

Fall 2020 "Identification of Adverse Operational Conditions in Sociotechnical Systems: A Data Analytics Approach", *Conference on Systems Engineering Research (CSER)*, (virtually in) Los Angeles, CA

Spring 2020 "DEA in Heterogeneous Production Possibility Sets: A Comprehensive Reality Check", *North American Productivity Workshop XI*, (virtually in) Miami, FL

Fall 2019 "Workload Quantification and Distribution in Socio-technical Infrastructure Management Systems." *INFORMS Annual Summit*, Seattle, WA

Spring 2019 "Workload Quantification and Distribution in Socio-Technical Infrastructure Management Systems: Human vs. Autonomous Systems." *European Workshop on Efficiency and Productivity Analysis (EWEPA)*, London, UK

Spring 2019 "Performance Measurement in Complex Socio-Technical Systems." *the 35th Graduate Student Association Research Symposium*, Blacksburg, VA

Spring 2018 "Estimation of the Workload Boundary in Socio-Technical Infrastructure Management Systems." *North American Productivity Workshop X*, Miami, FL

Spring 2015 "Customer, Commercial, and Government Value Functions for Electric Vehicle System Design." *Institute of Industrial and Systems Engineers (IISE) Annual Conference*, Nashville, TN

Teaching Experience

COURSES TAUGHT

Fall 2022	ISE 4984/5834 Decision Analysis for Engineers , Instructor of Record	<i>Virginia Tech</i>
Fall 2021	EMSE 2801 Fundamentals of Systems Engineering , Instructor of Record	<i>GWU</i>
Spring 2020	ENGR 5204 the Systems Engineering Capstone Research Process , Instructor of Record	<i>Virginia Tech</i>

COURSES SUPPORTED

2016-2020	ENGR 5004 Foundations of Systems Engineering , Teaching Assistant	<i>Virginia Tech</i>
2017-2020	ISE 5174 Engineering Program and Project Management , Teaching Assistant	<i>Virginia Tech</i>
2016-2019	ISE 5144 Performance and Productivity Measurement and Evaluation , Teaching Assistant	<i>Virginia Tech</i>
2015-2017	ISE 5015 Management of Change, Innovation, and Performance in Organizational Systems , Teaching Assistant	<i>Virginia Tech</i>

Mentoring

GRADUATE STUDENTS

2021-2022	Shweta Mulcare , D.Eng Student @ <i>Engineering Management and Systems Engineering</i> • Advised under supervision of Dr. Szajnfarter	<i>GWU</i>
2020-2022	Mohammad Beigi , PhD Student @ <i>ISE</i> • Assisted with scholarly development	<i>Virginia Tech</i>
2019-	Saman Mohsenirad , PhD Candidate @ <i>Economics & ISE</i> • I am a Committee Member on Saman's Dissertation	<i>Virginia Tech</i>
2020 - 2021	Anthony Hennig , PhD Candidate @ <i>Engineering Management and Systems Engineering</i> • Assisted with scholarly development, co-authored J4, J5, C3, & C4	<i>GWU</i>
2020-2021	Lihui "Lydia" Zhang , MS @ <i>Institute for Data, Systems, and Society</i> • Currently Data Scientist @ McKinsey & Company • Assisted her thesis under supervision of Dr. Szajnfarter and co-authored C7	<i>MIT</i>
2018-2020	Ning-Yuan "Georgia" Liu , PhD Candidate @ <i>ISE</i> • Assisted her dissertation under supervision of Dr. Triantis	<i>Virginia Tech</i>

UNDERGRADUATE STUDENTS

2021-2022	Daniel Fisher , Undergraduate @ <i>EMSE</i> , minor in CS • Mentored undergraduate research on the intersection of ML & Sociotechnical Systems	<i>GWU</i>
2019-2020	Deirdre Cahill , Undergraduate @ <i>ISE</i> , currently Health Systems Engineer at Duke University • advisor during ISE Senior Design Competition	<i>Virginia Tech</i>
2019-2020	S. Matthew Garlington , Undergraduate @ <i>ISE</i> , currently Analyst at Deloitte • advisor during ISE Senior Design Competition	<i>Virginia Tech</i>
2019-2020	Olivia Reed , Undergraduate @ <i>ISE</i> , currently Consultant at KPMG • advisor during ISE Senior Design Competition	<i>Virginia Tech</i>
2019-2020	Pranay Shah , Undergraduate @ <i>ISE</i> , currently Software Engineer at Fidelity Investments • advisor during ISE Senior Design Competition	<i>Virginia Tech</i>

Outreach & Professional Development

SERVICE AND OUTREACH

2020-2021	EMSE Invited Seminar Series , Organizer	<i>GWU</i>
2021	CESUN Virtual Get Together Event , Assisted with the Organization	<i>GWU</i>
2019-2020	ISE Mentoring Program , Graduate Student Mentor	<i>Virginia Tech</i>

DEVELOPMENT

2021	ASME IDETC Establishing a Digital Presence , Participated to learn about broader dissemination strategies through social media	<i>Virtual</i>
2019	INFORMS Teaching Effectiveness Colloquium , Participated to learn about teaching methods	<i>Seattle, WA</i>
2019	SEANET, Conference on Systems Engineering Research (CSER) Doctoral Colloquium , Participated to learn about life in the academia & research methods	<i>Washington, DC</i>
2018	INFORMS Doctoral Colloquium , Participated to learn about life in the Academia	<i>Phoenix, AZ</i>
2018	NSF Harvest Research Coordination Network , Represented VT ISE to capture the needs of U.S. small-scale farmers and frame research projects to address their needs	<i>Washington, DC</i>
2016	NSF CMMI 1548480 - Abstraction and Elaboration in Systems Engineering Workshop , Assisted with the organization and ideated with the leaders of the SE community	<i>Frost, WV</i>

PEER REVIEW

- Design Science
- ASME Journal of Mechanical Design
- European Journal of Operations Research
- INCOSE Systems Engineering
- IEEE Transactions on Engineering Management
- IEEE Open Journal of Systems Engineering
- Journal of Engineering Management
- Annals of Operations Research

PROFESSIONAL MEMBERSHIPS

- Member, Design Society
- Member, International Council of Systems Engineering (INCOSE)
- Member, American Society of Mechanical Engineers (ASME)
- Member, The Institute for Operations Research and the Management Sciences (INFORMS)