

DANIEL ZWILLINGER, PhD

Chief Scientist / Applied Mathematician

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PROFESSIONAL SUMMARY

Chief Scientist and applied mathematician with 40+ years of experience solving technical and business problems for government research labs, defense primes, consulting firms, and academia. Principal Investigator on federally funded research programs for AFRL and DARPA, spanning game theory, Koopman operator theory, linear temporal logic, multi-object tracking, and decentralized data fusion. Holds 7 issued and 1 pending U.S. patent; authored or edited 6+ published reference books, including Standard Mathematical Tables and Formulae, a 100-year bestseller; and maintains an active peer-reviewed publication and conference presentation record. Six Sigma (6σ) Black Belt, both Raytheon- and ASQ-certified. Experienced working in DoD research environments and on federally funded programs.

EDUCATION

PhD, Applied Mathematics California Institute of Technology (Caltech), Pasadena, CA | 1983

BS, Mathematics Massachusetts Institute of Technology (MIT), Cambridge, MA | 1978

AREAS OF EXPERTISE

Technical Project Management | Research Leadership | Lean Six Sigma | Data Analysis | Modeling & Simulation | Algorithm Design | Game Theory | Applied Mathematics | MATLAB, Mathematica, Python

PROFESSIONAL EXPERIENCE

BAE Systems, Burlington, MA Chief Scientist | 2018–2025

- Principal Investigator on multiple research programs using Koopman analysis, game theory, and linear temporal logic, with program values up to \$4M; led research proposals for AFRL and DARPA.
- Led the team that created a patented decentralized data fuser; led IRAD projects on game theory and multi-object tracking; mentored junior scientists.
- Determined whether geographically distributed drones are headed to a common location (DARPA).
- Optimized attacking and defending strategies of supply chains using game theory (AFRL).
- Designed and evaluated Course of Action (COA) metrics aligned with Surprise, Blinding, and Offensive dimensions (AFRL).
- Used Koopman models to create fast simulators for deep learning by autonomous vehicles (DARPA).

Autoliv, Lowell, MA Validation Manager | 2015–2018

- Led a team that designed and built data collection systems, performed environmental testing, and determined radar performance using a fleet of 19 vehicles with 6 full-time drivers and 3 full-time mechanics; improved capability and capacity through process improvements.
- Sped up construction of \$50K data collection systems.
- Created models for radar calibration and synchronization; experienced with ISO 17387.

Raytheon, Sudbury, MA Senior Principal Systems Engineer & Six Sigma Black Belt | 2001–2015

- SW requirements lead for the C-Band Radar Project Line.
- SW requirements lead for Pre- and Post-Mission Software for Cobra Judy Replacement (CJR).
- SW test lead for Multiple Hypothesis Tracking on UEWR; “sold off” requirements to the government.
- HW test lead for X-band radar calibration exercise at Yuma, AZ (year-long activity).
- Led systems engineering, usability, and deployment for an improved Time Card system.
- Achieved \$42M benefit (audited) from three largest improvement projects.
- Twice won “President’s Best Six Sigma Project of the Year”; four-time winner of the “Raytheon Innovation Challenge.”
- Reduced cost of the VV&A (Verification, Validation & Accreditation) process for the Zumwalt destroyer (DDG-1000).
- Reduced cost of the Patriot Missiles Rolling Wave process (converting planning packages to work packages).
- Subject Matter Expert (SME) in Design for Six Sigma, Critical Chain Program Management, and Voice of the Customer.

- Led the “Trust in Autonomous Systems” effort — two conference presentations and a book chapter in one year.
- Managed, and frequently taught, the Six Sigma white/yellow belt training class (5 years).

ADDITIONAL RELEVANT EXPERIENCE

Exxon Research and Engineering • Jet Propulsion Laboratory (JPL) • Sandia National Laboratories • The MITRE Corporation • Institute for Defense Analyses (IDA) • Bolt Beranek & Newman (BBN) • IronBridge Networks

ACADEMIC EXPERIENCE

Rensselaer Polytechnic Institute, Troy, NY **Assistant Professor of Mathematics & Computer Science** |

- Taught graduate and undergraduate courses in information theory, probability, statistics, linear algebra, discrete mathematics, differential equations, complex variables, and advanced calculus.
- Published papers on wave theory, information theory, materials engineering, and algorithmic design.

ENTREPRENEURIAL EXPERIENCE

- Founded a consulting firm, Aztec Corporation; handled business development, project and personnel management, proposal writing, and client negotiations.
- Created the first release of MATLAB’s statistics toolbox for The MathWorks.
- Principal Investigator on Air Force SBIR contracts to develop automated test equipment.
- Managed a Department of Transportation SBIR contract to develop CAD tools for luggage simulations.
- Rewrote the mathematical reference manual for the computer algebra system Macsyma.
- Co-created and sold US Patent 9,412,280 to Uber; describes how to deliver goods by drone.
- Created three US Patents for seamless data transfer between devices.
- Filed a pending US Patent for space-based power generation (filed August 2026).

RESEARCH SPONSORS (SELECTED)

Air Force Research Laboratory (AFRL) • DARPA • Air Force • Department of Transportation

PATENTS

- Chamber-Less Thin-Film Deposition in Vacuum Environments — Zwillinger; patent pending (filed Aug 2026). Exploits the vacuum of space to create solar cells on the Moon or in planetary orbit.
- Movement Initiated Automated Information Transfer — Zwillinger; US 12,732,229 (2026). Uses an acceleration vector to transfer information between devices without contact or a user interface.
- Impact Initiated Automated Information Transfer (2 patents) — Zwillinger; US 12,284,001 and US 12,425,073 (2025); pending in China, Europe, and India. Uses an acceleration vector to transfer information between devices on contact, without a user interface.
- Custodianship Model for Decentralized Track Fusion — E. Duchon, I.-J. Nelson, S. Li, H. Vo, and Zwillinger; US 11,057,740 (2021). Distributes tracking information among a drone swarm.
- Cooperative System and Method for Precise Autonomous Delivery — Zwillinger, R. Hettich, and J. Cogliandro; US 9,412,280 (2016). Patented in the US, Canada, EU, and Japan; sold to Uber. Informs a drone where to deliver a package.
- Tarp Having a Unique Identifier and a Plurality of Grommets for Drone Navigation (design patent) — Zwillinger, R. Hettich, and J. Cogliandro; USD797648S1 (2017).
- Tarp with Sleeve for Drone Navigation (design patent) — Zwillinger, R. Hettich, and J. Cogliandro; USD796418S1 (2017).

PUBLISHED BOOKS

- Editor-in-Chief, Standard Mathematical Tables and Formulae, CRC Press, 30th–33rd editions, 1996–2018; 34th edition in preparation (2027). First edition published 1928; over two million copies sold.
- Editor-in-Chief, Tables of Integrals, Series, and Products (Gradshteyn & Ryzhik), Academic Press, 6th–8th editions, 2000–2014; 9th edition in preparation (2027).

- Zwillinger and V. Dobrushkin, Handbook of Differential Equations, Chapman and Hall/CRC, 1st–4th editions, 1989–2021.
- Zwillinger, Handbook of Integration, Jones and Bartlett, 1992.
- Zwillinger and S. Kokoska, Standard Probability and Statistics Tables and Formulae, Chapman and Hall/CRC, 2000.
- E. Mendelson and Zwillinger, Introducing Game Theory and Its Applications, 2nd edition, Chapman and Hall/CRC, 2024.
- Zwillinger, Six Sigma Tools in Six Minutes, self-published, 2025 (Amazon and free at sixsigmainixminutes.com).
- Advisory Editor, Handbook of Chemistry and Physics, CRC Press, 85th–97th editions, 2004–2016.
- Editor-in-Chief, CRC “Advances in Applied Mathematics” book series, 2013–2026.

PUBLICATIONS — REFEREED

- Zwillinger, B. Foley, and K. Mittelstaedt, “Six Sigma Tools in Six Minutes,” Six Sigma Forum Magazine, Vol. 15, No. 2, Feb 2016.
- Zwillinger, “As Easy as 1, 3, 9?” Six Sigma Forum Magazine, Vol. 12, No. 4, Aug 2013, pp. 23–26.
- Zwillinger, “Coarsening of Non-Spherical Particles,” Journal of Crystal Growth, 94(1), 1989, pp. 159–165.
- Zwillinger, “Differential PPM has a Higher Throughput than PPM for the Band-Limited and Power-Limited Optical Channel,” IEEE Transactions on Information Theory, 34(5), Sept 1988, pp. 1269–1273.
- Zwillinger, “Morphological Stability of Two Particle Diffusion in Three Dimensions,” Journal of Crystal Growth, 74(1), 1986, pp. 48–56.
- Zwillinger, “Random Sum of Sines,” Applied Acoustics, 19, 1986, pp. 305–307.
- Zwillinger and B. S. White, “Propagation of Initially Plane Waves in the Region of Random Caustics,” Wave Motion, 7, 1985, pp. 207–227.
- Zwillinger, “A Goldbach Conjecture Using Twin Primes,” Mathematics of Computation, 33(147), July 1979, p. 1071.

PUBLICATIONS — OTHER

- Zwillinger and P. San Clemente, “Game theory analysis when playing the wrong game,” 17 Jul 2023, arxiv.org/abs/2307.10257.
- A. Metzner and Zwillinger, “Kuhn Poker with Cheating and Its Detection,” 9 Nov 2020, arxiv.org/abs/2011.04450.
- G. Palmer, A. Selwyn, and Zwillinger, “The ‘Trust V’: Building and Measuring Trust in Autonomous Systems,” in Robust Intelligence and Trust in Autonomous Systems (pp. 55–77), Springer, April 2016.
- Zwillinger, “Voting Power of Teams Working Together,” 12 Dec 2013, arxiv.org/abs/1312.3394.
- E. Brookner, B. Porter, K. Chang, Y.-C. Chang, Zwillinger, B. Considine, and T. Sikina, “Demonstration of accurate prediction of PAVE PAWS embedded element gain,” 2010 IEEE Intl. Symposium on Phased Array Systems and Technology, pp. 417–422, Oct 2010.
- Zwillinger, Judge’s Commentary essays (Outstanding Papers), The Journal of Undergraduate Mathematics and Its Applications: Irrigation (2006), Flood Planning (2005), Grade Inflation (1998), Helix Intersections (1995).
- M. T. Strauss and Zwillinger, “Luggage Simulation,” CADalyst, Oct 1995, p. 29.
- M. T. Strauss and Zwillinger, “A Luggage Simulation Tool,” Final Report, DOT contract DTRS-57-93-C-00113, March 1994.
- Zwillinger, “Visualization of Circuit Card EM Fields,” US Government report, AD-A347-002, March 1998; and AD-A291-491, January 1995.
- Zwillinger and M. Sousa, “Analytical Determination of the Matrix Pseudo-Inverse,” Macsyma Newsletter, VII(3), July 1990, pp. 1–8.
- S. Marsh, M. Glicksman, and Zwillinger, “Statistical Mechanics of Mushy Zones,” Modeling and Control of Casting and Welding Processes IV, The Metallurgical Society, 1988, pp. 921–928.
- Zwillinger, “Completing The L-th Power in $\mathbb{Z}[x]$,” SIGSAM Journal of the ACM, 18(3), issue 71, pp. 20–22, Aug 1984.

PRESENTATIONS (SELECTED)

- D. C. Fox et al., Zwillinger et al., “Resolution for Object Detection in Satellite Imagery: A Class-Specific Approach,” NCTA 2025, 17th Intl. Conf. on Neural Computation Theory and Applications, Marbella, Spain, Oct 2025.
- Zwillinger and M. Gerken, “Mathematical modeling and analysis of aircraft flight data,” MORS Emerging Techniques Forum, Laurel, MD, Dec 2023.
- Zwillinger, “Math Models & Tools (Not Mathematical Modeling),” Tufts University Mathematics graduate student presentation, March 2023.
- Zwillinger, J. Sierchio, M. Gerken, and E. Clark, “Distributing data throughout a MANET in a communications-denied environment: reinforcement learning and game theory approaches,” SPIE Defense + Commercial Sensing, Orlando, FL, June 2022 (doi.org/10.1117/12.2618517).
- Zwillinger, “Topics in differential equations: exact, approximate, and numerical,” Tufts University Mathematics graduate student presentation, March 2021.
- A. Metzner and Zwillinger, “Cheating and its detection in games such as poker and paintball,” Joint Mathematics Meeting, Denver, CO, Jan 2020.
- L. Bookman, J. Ubnoske, and Zwillinger, “Classifying the difficulty of the k-clique problem,” Joint Mathematics Meeting, Baltimore, MD, Jan 2019.
- A. Zagorianakos and Zwillinger, “Assessing Design Impact Using a Multi-Accurate Measurement Model,” SAE World Congress Experience (WCX 17), Detroit, MI, March 2017.

PRESENTATIONS (SELECTED), CONTINUED

- Zwillinger, “Six Sigma Tools in Six Minutes,” ASQ Granite State Section, NH, May 2016; and ASQ Merrimack Valley Section, MA, April 2016.
- S. P. Marsh, C. S. Pande, M. E. Glicksman, and Zwillinger, “Environmental noise effects in statistical coarsening theory,” Materials Research Society meeting, April 1998.
- Zwillinger, “Computer Verification of Integral Tables,” 1993 SIAM National Meeting, Philadelphia, July 1993.
- S. P. Marsh, Zwillinger, and M. E. Glicksman, “A General Geometric Model of Coarsening: Mathematical Development I & II,” invited papers, 1988 SIAM National Meeting.
- Zwillinger, S. P. Marsh, and M. E. Glicksman, “Statistical Mechanics of Mesoscale Behavior,” contributed paper, 1987 SIAM National Meeting.

STUDENT MENTORSHIP & PROFESSIONAL SERVICE

- Mentor, collegiate student capstone/qualifying projects (BAE Systems funded):
 - RPI capstone project on recovering building floorplans from exfiltrated cell-phone data (2020).
 - RPI capstone project on drone-based identification of people at burning buildings (2021).
 - WPI MQP (Major Qualifying Project) on multi-drone building-interior survey speed (2023).
 - WPI GQP (Graduate Qualifying Project) on pixel requirements for object identification (2024).
- Visiting SIAM (Society for Industrial and Applied Mathematics) lecturer, 1992–1999 — lectured undergraduates on applied mathematics at WPI, URI, and other institutions.
- Google Scholar (September 2026): 8,306 total citations (2,49 since 2020); h-index 12; i10-index 13.