

Exponent®
Engineering & Scientific Consulting

Nareg Sinenian, Ph.D.

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Professional Profile

Nareg Sinenian, Ph.D., is a principal scientist in the Electrical Engineering & Computer Science practice at Exponent with expertise in the fields of applied physics, electrical engineering and computer science, and nuclear engineering. He has over 10 years of experience in electronics and power systems consulting, specializing in the design, analysis, and investigations of electrical circuits and systems, control systems, and power electronics and systems. He advises clients across the energy, industrial, and technology sectors and provides expert testimony in support of domestic and international disputes.

Dr. Sinenian also has expertise in applying data analytics, algorithms, and machine learning to large datasets to understand underlying component or system behavior. He is proficient in numerous programming languages, including C, C++, Java, and Python. Dr. Sinenian is involved in open-source software development and is the co-author of a book on data structures and algorithms.

Before joining Exponent, Dr. Sinenian conducted plasma physics research exploring applications in space propulsion and nuclear fusion energy. During his studies, he built nuclear instrumentation to study aspects of laser inertial fusion in support of the U.S. national laser fusion program. As part of this work, he examined the effects of laser-generated hot electron preheat, including its effect on fluid compression, and fusion implosion performance and associated fast-ion generation.

Technical Services

Independent Design Reviews and Technical Assessments

Dr. Sinenian has advised corporate leadership and management on business and technical matters. He has conducted investigations and design reviews of circuits and systems to assist clients during engineering and development to address the root causes of field failures and in various dispute contexts.

International Arbitration Support and Expert Testimony

Dr. Sinenian has conducted numerous technical investigations and merits assessments in the context of international disputes. He has given expert evidence before commercial courts and arbitral tribunals on matters involving control systems, electrical and power systems, and electronic circuits and systems and the components used therein.

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Areas of Expertise

Control Systems

Dr. Sinenian has design and implementation experience with the hardware and software in control systems and related technology. He has analyzed dynamic control algorithms in embedded systems and products in the context of failure analysis and assisted clients with software and signal processing related matters. He has authored modular and extensible control system software, which was described in a trade journal. He has advised on the design and implementation of control systems (e.g., SCADA, DCS, PLCs) and protection systems (at various levels) associated with various types of power plants, processing plants, and oil and gas pipelines, and he has analyzed numerous field failures in these systems. He has also addressed the implementation requirements for such systems in large-scale processing plants, including low-level infrastructure and integration of high-level software with plant control, monitoring, and production (output) tracking functions.

Power Systems

Dr. Sinenian has assessed the design of power systems and the integration of power system components into products and infrastructure. His experience includes transformers, power capacitors, a wide variety of circuit breakers and other protective devices, as well as electric motors and generators. He has experience with both electronics and electrical power systems in various sectors, including industrial processing facilities, oil and gas, transportation, and conventional, nuclear, and renewable power plants. He has advised utilities, contractors, and project owners before, during, and after construction on aspects of electrical design in both dispute and non-dispute settings.

Electronic Circuits and Systems

Dr. Sinenian has significant design experience with electronic circuits and systems, including microelectronics (analog and mixed-signal design), radio-frequency circuits and systems, and power electronics. As part of his consulting work, he has assessed the design of circuits (including integrated circuits) and assemblies for clients and proposed enhancements and modifications to achieve target performance specifications. He has practical experience with root-cause analysis of circuits, systems, and components and has performed numerous design reviews. During his time at MIT, he was a teaching assistant for courses involving advanced analog and mixed-signal circuit techniques, feedback control systems, and radio-frequency circuits and systems.

Academic Credentials & Professional Honors

Ph.D., Nuclear Science and Engineering, Massachusetts Institute of Technology (MIT), 2013

M.S., Electrical Engineering and Computer Science, Massachusetts Institute of Technology (MIT), 2008

M.S., Nuclear Science and Engineering, Massachusetts Institute of Technology (MIT), 2008

B.S., Physics, University of California, San Diego, 2005

UCSD Physics Best Project (Winter 2005): GPS-navigated Autonomous Rover

UCSD Marshall College Provost's Honors

Licenses and Certifications

Udacity Certified ML Engineer

PADI Certified Open Water Scuba Diver

Languages

Armenian

Publications

Sinenian N, et al., Chapter 1: Advances in Power Converters. D'Andrade, Brian W. (Editor), The Sustainable Power Grid: Challenges, Applications, and Case Studies. Book, ISBN 9780443134425, 2024.

Klopp, R, Martens, J, and Sinenian, N. Today's Complex Mining and Minerals Disputes Favor Breadth Over Depth in Expertise, Mining Arbitration Report, Jus Mundi, March 2022.

Zhang, Q, Sinenian, N, and Huang, R. Investigations on Electrolytic Capacitors to Improve Reliability under Assembly-Level Impact Conditions; IEEE International Conference on (ICEPT) Electronic Packaging Technology, 2019.

Sinenian, N. and Shai, D., Chapter 3: Advances in Power Converters. D'Andrade Brian W. (Editor), The Power Grid: Smart, Secure, Green and Reliable. Book, ISBN 978-0-12-805321-8, 2017.

Jagannathan S, Sinenian N. Algorithms and data structures in Python. ISBN: 9781502378712. 2014.

Sinenian N, Manuel M J-E, Frenje, JA, et al. An empirical target discharging model relevant to hot-electron preheat in direct-drive implosions on OMEGA. Plasma Physics and Controlled Fusion 2013; 55(4).

Sinenian N, Zylstra AB, Manuel M, et al. A multithreaded modular software toolkit for control of complex experiments. Computing in Science and Engineering 2013; 15(1):65.

Sinenian N, Theobald W, Frenje JA, et al. Proton emission from cone-in-shell fast-ignition experiments at Omega. Physics of Plasmas 2012; 19(11):112,708.

Sinenian N, Fiksel G, Frenje JA, et al. Heavy-ion emission from short-pulse laser-plasma interactions with thin foils. Physics of Plasmas 2012; 19(9):093,118.

Sinenian N, Zylstra AB, Manuel MJ-E, et al. Total energy loss to fast ablator-ions and target capacitance of direct-drive implosions on OMEGA. Applied Physics Letters 2012; 101(11):114,102.

Sinenian N, Manuel MJ-E, Zylstra AB, et al. Upgrade of the MIT Linear Electrostatic Ion Accelerator (LEIA) for nuclear diagnostics development for Omega, Z, and the NIF. Review of Scientific Instruments 2012; 83(4):043502.

Sinenian N, Rosenberg MJ, Manuel M, et al. The response of CR-39 nuclear track detector to 1-9 MeV protons. Review of Scientific Instruments 2011; 82(10).

Presentations

Sinenian N. Watts in Arbitration? The Development of Energy Arbitration. AIAC Asia ADR Week, Asian International Arbitration Centre (Defects in Solar PV and Wind Installations), Kuala Lumpur, Malaysia, August 29-21, 2021.

Sinenian N. An empirical target discharging model for direct-drive implosions on OMEGA. 54th Annual Meeting of the APS Division of Plasma Physics, Providence, RI, November 2, 2012.

Sinenian N. Measurements of deuteron ablator-ion energy spectra for studies of energy-loss and preheat in direct-drive implosions on OMEGA. Doctoral Seminar at the Plasma Science & Fusion Center, MIT, Cambridge, MA, December 13, 2011.

Sinenian N. Measurements of the ablator-ion energy-loss channel in direct-drive implosions on OMEGA. 53rd Annual Meeting of the APS Division of Plasma Physics, Salt Lake City, UT, November 14, 2011.

Sinenian N. Implementation of a Thomson Parabola for improved fast-ion measurements and nuclear physics studies. Laboratory for Laser Energetics Theory Group Meeting, Rochester, NY, September 27, 2011.

Sinenian N. Observations of energetic protons in recent integrated fast-ignition experiments at the OMEGA Laser Facility. Doctoral Seminar at the Plasma Science & Fusion Center, MIT, Cambridge, MA, November 11, 2010.

Sinenian N. The role of nuclear particles at OMEGA, OMEGA EP, and the NIF. Doctoral Seminar at the Plasma Science & Fusion Center, MIT, Cambridge, MA, October 28, 2009.

Project Experience

Dr. Sinenian has performed numerous independent design reviews and technical assessments involving electrical components and systems, including industrial and consumer products, and equipment found in large, complex infrastructure installations. He has given expert evidence on related matters in disputes before courts and tribunals. Some representative (non-exhaustive) examples of his technical work include the following.

Control systems

- Design reviews of motor control systems and associated power electronics, including analysis of associated software or embedded control algorithm for both consumer and industrial products.
- Root-cause analysis of a major power plant control system failure that led to cascading faults in the power network in the Asia-Pacific region.
- Evaluation of design and testing of a control system for a pipeline, including assessment of factory-acceptance tests (FATs) and site-acceptance testing (SAT).
- Analysis of feasibility for hot changeover of a control system during commissioning of a petrochemical facility.

Power systems

- Evaluation of the design of emergency and backup power generation systems (including associated battery systems) and emergency diesel generators for data centers, industrial processing plants, and other infrastructure.
- Root-cause of failures associated with auxiliary power units (APUs) for use in the transportation sector.
- Design review of a medium-voltage system for an industrial processing plant, including an analysis of propensity for power supply instability arising from non-linear effects.

- Root-cause analysis of field failures of switchgear (for a wide range of operating voltages), including gas-insulated switchgear (GIS), involving power plants, industrial processing plants, and electrical substations.

Electronic Circuits and Systems

- Design reviews and evaluation of capacitive sensing circuitry, including discrete and integrated circuitry for use in fluid level sensing and touch screen applications.
- Evaluation of radio-frequency transceiver designs for military applications, including analog architecture and associated modulation and digital signal processing techniques.
- Root-cause analysis of capacitor failures in the context of power electronics, including evaluation of capacitor design and manufacturing processes and use-case dependent factors in a wide range of industries.
- Design and failure modes effects analysis (DFMEA) for a variety of prototype consumer products and systems, including assessment of compliance with prevailing international standards.