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Engineering & Scientific Consulting

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Professional Profile

Dr. Ajdari is an expert in mechanical engineering analysis, solid mechanics, finite element analysis, design optimization and biomechanics. He has more than 8+ years of experience in utilizing simulation methods and experimental design for product development processes which help delivering products that are right the first time and robust to uncertainty.

Dr. Ajdari has worked on a range of projects involving both litigation and non-litigation failure analyses to understand the underlying root cause of reported matters. His expertise has been applied to numerous failure and design analyses in multiple industries including energy storage and batteries, medical devices, biotechnology, consumer products, defense/military applications, boilers & pressure vessels, industrial heat exchangers, oil and gas industry, railroad industry, and automotive industry. He has extensive experience in performing advanced analyses including structural, thermal, thermo-mechanical, fatigue, crack-propagation modeling, crash and impact analysis.

Prior to joining Exponent, Dr. Ajdari was a Senior Engineer at DePuy Synthes Spine, a Johnson & Johnson Company, supporting product development and sustaining efforts related to multiple spine implants and surgical devices. He is familiar with regulatory design requirements for medical devices, explicitly, verification and validation efforts. Prior to that, he was a Lead Engineer at GE Energy Storage working on design and development of GE battery products, thermal management, and cooling system design for Li-ion and high temperature sodium metal battery systems. Dr. Ajdari received his Green Belt Six-Sigma certification while he was at GE, working on a project to understand and resolve battery cell pre-mature failure due to crack formation in the glass seal area of the cells.

Dr. Ajdari earned his PhD in Mechanical Engineering in Dec 2011, followed by two postdoctoral fellowships at MIT (2012-2013) and Northwestern University (2012-2014) working on multi-disciplinary projects including the design of high performance nanoparticle rubber composites for tire compound, study the mechanics and dynamics of instability and deformation localization in thin elastic shells, structural strength of reinforced concrete chimneys subject to an uncontrolled fire, and structures with superior and tailorable mechanical properties.

His scientific publications include 20 peer-reviewed journal publications with over 1,250+ citations (as of June 2020), and more than 53+ conference proceedings and presentations, and 4 patent disclosures. He currently serves as an active member of ASME V&V60 subcommittee on Verification and Validation of Computational Modeling in Energy Systems.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Northeastern University, 2012

M.S., Mechanical Engineering, Northeastern University, 2008

B.S., Mechanical Engineering, University of Tehran, Iran, 2004

NSF CMMI "Civil, Mechanical, and Manufacturing Innovation" Student Award, 2011

11th U.S. National Congress on Computational Mechanics Student Award, 2011

Joseph Ferretti Academic Excellence Fellowship, Northeastern University, 2010

10th U.S. National Congress on Computational Mechanics Student Award, 2009

Licenses and Certifications

GE Green Belt in Lean Six Sigma, #625131-713714-212407395, 2015

Licensed Professional Engineer, New York, #101283

Academic Appointments

e-Instructor, Department of Mechanical Engineering, MIT, 2012

Lecturer, Department of Mechanical Engineering, Northeastern University, 2010

Prior Experience

Senior R&D Engineer, DePuy Synthes Spine, Johnson & Johnson, Raynham, MA 2017-2018

Lead Mechanical Engineer, General Electric Energy Storage, Schenectady, NY 2014-2017

Postdoctoral Research Associate, Northwestern University, Evanston, IL 2012-2014

Research Fellow, Massachusetts Institute of Technology, Cambridge, MA 2012-2013

Research Engineer, Abiomed, Danvers, MA 2008

Service Engineer, Cummins Diesel, Tehran, Iran 2004-2006

Professional Affiliations

American Society of Mechanical Engineering (ASME), 2006-present

Society of Experimental Mechanics (SEM), 2010-present

American Physical Society (APS), 2011-present

Patents

US 2018/0062230 A1: Airflow Cooling for an Energy Storage System, 2018.

US 2017/0069939 A1: Heat Flux Assembly for an Energy Storage Device, 2017.

Publications

- K. Bhamidipati, J. Lindsey, A. Ajdari, J. Browell, S. Hollo, K. J. Frutschy, "Sodium Metal Halide Battery Thermal Design for Improved Reliability", *J. of Electrochemical Energy Conversion and Storage*, 2018.
- A. Hu, X. Li, A. Ajdari, B. Jiang, L.C. Brinson, C. Burkhardt, W. Chen, "Computational analysis of particle reinforced viscoelastic polymer nanocomposites", *J. Mechanics and Physics of Solids*, 2018.
- C.D. Wood, A. Ajdari, C.W. Burkhardt, K.W. Putz, L.C. Brinson, "Understanding competing mechanisms for glass transition changes in filled elastomers", *Composites Sci. and Tech.*, 127 (2016) 88-94.
- D. Mousanezhad, H. Ebrahimi, B. H. Jahromi, R. Ghosh; A. Ajdari; A. M. S. Hamouda, A. Vaziri, "Spiderweb honeycombs", *Int. J. Solids and Structures*, 66 (2015) 218-227.
- D. Mousanezhad, R. Ghosh, A. Ajdari, A.M.S. Hamouda, H. Nayeb-Hashemi, A. Vaziri, "Impact resistance and energy absorption of regular and functionally graded hexagonal honeycombs with cell wall material strain hardening", *Int. J. Mechanical Sciences*, 89 (2014) 413-422.
- H. Ebrahimi, A. Ajdari, D. Vella, A. , A. Vaziri, "Anisotropic Blistering Instability of Highly Ellipsoidal Shells", *Physical Rev Letters*, 112 (2014) 094302.
- A. Nasto, A. Ajdari, A. Lazarus, A. Vaziri, P.M. Reis, "Localization of deformation in thin shells under indentation", *Soft Matter*, 9 (2013) 6796-6803. [Special Themes Issue on "Emerging Investigators in Soft Matter"]
- D. Vella, A. Ajdari, A. Vaziri, A. Boudaoud, "Indentation of ellipsoidal and cylindrical elastic shells", *Physical Rev Letters*, 109 (2012) 144302. [Press reports: InsideScience.org, LeMonde.fr, slate.com, and Scientific American blog]
- A. Ajdari, B. H. Jahromi, J. Papadopoulos, H. Nayeb-Hashemi, A. Vaziri, "Hierarchical honeycombs with tailorable properties", *Int. J. Solids Structure*, 49 (2012) 1413-1419.
- S. Babaei, B.H. Jahromi, A. Ajdari, H. Nayeb-Hashemi, A. Vaziri, "Mechanical properties of open-cell rhombic dodecahedron cellular structures", *Acta Materialia.*, 60 (2012) 2873-2885.
- D. Vella, A. Ajdari, A. Vaziri, A. Boudaoud, "The indentation of pressurized elastic shells: From polymeric capsules to yeast cells", *J Royal Society Interface*, 9 (2012) 448-455.
- M. Ashrafi, A. Ajdari, N. Rahbar, J. Papadopoulos, H. Nayeb-Hashemi, A. Vaziri, "Single lap adhesively bonded joints with non-flat interfaces", *Int. J. Adhesion & Adhesives*, 32 (2012) 46-52.
- D. Vella, A. Ajdari, A. Vaziri, A. Boudaoud, "Wrinkling of pressurized elastic shells", *Physical Rev Letters*, 107 (2011) 174301.
- Press reports: *Physics World* and *physicsworld.com*; College of Engineering, Northeastern University.
- A. Vaziri, A. Ajdari, A. A. Twohig, H. Ali, "Structural reliability of reinforced concrete chimneys subjected to uncontrolled fire", *Engineering Structure*, 33 (2011) 2888-2889.
- A. Ajdari, H. Nayeb-Hashemi, A. Vaziri, "Dynamic crushing and energy absorption of regular, irregular and functionally graded cellular structures", *Int. J. Solids Structure*, 48 (2011) 506-516.
- S.C. Corbett, A. Ajdari, A.U. Coskun, H. Nayeb-Hashemi, "Effect of pulsatile blood flow on thrombosis potential with a step wall transition", *ASAIO*, 56 (2010) 290-295.

B.H. Jahromi, A. Ajdari, H. Nayeb-Hashemi, A. Vaziri, "Autofrettage of layered and functionally graded metal-ceramic composite vessels", *Composite Structures*, 92 (2010) 1813-1822.

S.C. Corbett, A. Ajdari, A.U. Coskun, H. Nayeb-Hashemi, "In vitro and computational thrombosis on artificial surfaces with shear stress", *Artificial Organs*, 34 (2010) 561-569.

A. Ajdari, P.K. Canavan, H. Nayeb-Hashemi, G. Warner, "Mechanical properties of functionally graded 2-D cellular structures: A finite element study", *J of Material Science and Engineering*, A 499 (2009) 434-439.

A. Ajdari, H. Nayeb-Hashemi, P.K. Canavan, G. Warner "Effect of defect on elastic-plastic behavior of cellular materials", *J of Material Science and Engineering*, A 487 (2008) 558-567.

Conference Proceedings and Presentations

A. Ajdari, K. Frutschy, "Optimizing Residual Thermal Stresses in Sodium Metal Halide Batteries", Conference on Advancing Analysis and Simulation in Engineering, CAASE20, June 2020.

A. Vaziri, B. H. Jahromi, A. Ajdari, H. Ebrahimi, P. Papadopoulos, H. Nayeb-Hashemi, "Plastic-Limit analysis of hierarchical honeycombs", *Plasticity*, Bahamas 2013.

A. Ajdari, B. H. Jahromi, A. M. Hamouda, A. Vaziri, " Hierarchical honeycombs with enhanced mechanical properties", 7th International Conference Supply on the Wings, Frankfurt, Germany 2012.

R. Oftadeh, B. H. Jahromi, A. Ajdari, A. Vaziri, "Fractal-Appearing hierarchical honeycombs", MRS Fall meeting, Boston 2012.

A. Ajdari, A. Nasto, A. Lazarus, A. Vaziri, P.M. Reis, "Localized deformation and instability of thin elastic shells upon indentation", *Proc. ASME IMECE2012-88308*, Houston, TX 2012.

M. Ashrafi, A. Ajdari, B. H. Jahromi, M. Olia, H. Nayeb-Hashemi, A. Vaziri, "Adhesively bonded joints with non-flat interfaces", *Proc. ASME IMECE2012-88007*, Houston, TX 2012.

B. H. Jahromi, A. Ajdari, R. Oftadeh, J. Papadopoulos, H. Nayeb-Hashemi, A. Vaziri, "Honeycombs with structural hierarchy", *Proc. ASME IMECE2012-88120*, Houston, TX 2012.

B. H. Jahromi, A. Ajdari, R. Oftadeh, H. Ebrahimi & A. Vaziri, "Mechanics of hierarchical honeycombs", NSF CMMI Research and Innovation Conference, Boston, MA, 2012.

B. H. Jahromi, A. Ajdari, A. Vaziri, "Intricate mechanics of hierarchical honeycombs", Society of Engineering Sciences (SES2012), Atlanta, GA 2012.

A. Nasto, A. Ajdari, A. Lazarus, A. Vaziri, P.M. Reis, "Localization (s-cones) in thin shells under indentation", Society of Engineering Sciences (SES2012), Atlanta, GA 2012.

A. Ajdari, B. H. Jahromi, H. Nayeb-Hashemi, A. Vaziri, "Hierarchical honeycombs with enhanced mechanical properties", XXIII International Congress of Theoretical and Applied Mechanics (ICTAM2012), Beijing, China 2012.

A. Ajdari, B. H. Jahromi, A. Vaziri, "Stiff honeycombs with structural hierarchy", European Congress on Computational Methods in Applied Sciences and Engineering, Vienna, Austria, 2012.

B. H. Jahromi, A. Ajdari, R. Oftadeh, A. Vaziri, "Hierarchical and fractal honeycombs with tailorable properties", Research, Innovation and Scholarship Expo (RISE 2012), Boston 2012.

- A. Ajdari, B. H. Jahromi, J. Papadopoulos, A. Vaziri, "Honeycombs with hierarchical organization", APS March Meeting, Boston, MA 2012.
- A. Nasto, A. Ajdari, A. Lazarus, A. Vaziri, P.M. Reis "S-cones in this shells under indentation", APS March Meeting, Boston, MA 2012.
- A. Ajdari, B. H. Jahromi, A. Vaziri, "Mechanics of hierarchical honeycombs", Plasticity, San Juan, PR 2012.
- A. Ajdari, B. H. Jahromi, A. M. Hamouda, A. Vaziri, "Hierarchical cellular structures with tailorable properties", Qatar Foundation Annual Research Forum, Doha, Qatar, 2011.
- A. Ajdari, B. H. Jahromi, A. Vaziri, "Fractal and hierarchical honeycombs", 48th Annual Technical Meeting of the Society of Engineering Science (SES2011), Evanston, IL 2011.
- A. Vaziri, A. Ajdari, "Localized features and patterns of strongly-deformed elastic shells", 48th Annual Technical Meeting of the Society of Engineering Science (SES2011), Evanston, IL 2011.
- A. Ajdari, A. Vaziri, "Multi-Scale mechanics of thin elastic shells upon point indentation", USNCCM 11, Minneapolis, MN 2011.
- A. Ajdari, B. H. Jahromi, A. Vaziri, "Structural stiffness of honeycombs with hierarchical organization", USNCCM 11, Minneapolis, MN 2011.
- A. Ajdari, A. Vaziri, "Mechanical properties and energy absorption of heterogeneous and functionally graded cellular structures", International Conference on the Mechanical Behavior of Materials (ICM11), Como Lake, Italy, 2011.
- S. Babaee, B.H. Jahromi, A. Ajdari, H. Nayeb-Hashemi, A. Vaziri, " Energy absorption of heterogeneous and functionally graded cellular structures ", Sixth MIT Conference on Computational Fluid and Solid Mechanics, Cambridge, MA 2011.
- A. Ajdari, S. Babaee, H. Nayeb-Hashemi, A. Vaziri, "Cellular structures with irregular structural organization", Engineering Mechanics Institute (EMI2011) Conference, Boston, MA, 2011.
- A. Vaziri, A. Ajdari, "Global and localized features of shell deformation and instability", Engineering Mechanics Institute (EMI2011) Conference, Boston, MA, 2011.
- S. Babaee, A. Ajdari, A. Vaziri, "Heterogeneous and functionally graded three-dimensional cellular materials", SEM Ann. Conf. on Exp. Appl. Mech., Uncasville, CT, 2011.
- A. Ajdari, A. Vaziri, "Multi-scale and cross disciplinary aspects of thin elastic shells", NSF CMII Research and Innovation Conference, Atlanta, GA, 2011.
- B.H. Jahromi, A. Ajdari, H. Nayeb-Hashemi, A. Vaziri, "Extended Variable Materials Property (X-VMP) method for elasto-plasto analysis of functionally graded materials and structures", NSF CMII Research and Innovation Conference, Atlanta, GA, 2011.
- A. Vaziri, S. Babaee, B.H. Jahromi, A. Ajdari, H. Nayeb-Hashemi, "Elasto-plasto properties and energy absorption of 3D tessellated cellular structures", Plasticity, 2011.
- A. Vaziri, B.H. Jahromi, A. Ajdari, H. Nayeb-Hashemi, "Extended variable materials property (X-VMP) method for elasto-plasto analysis", Plasticity, 2011.
- A. Ajdari, A. Vaziri, "Curvature-driven instability and wrinkling in elastic shells", MRS Fall Meeting, 2010.

A. Ajdari, L. Mahadevan, A. Vaziri, "Localization and curvature-driven wrinkling in elastic shells", New England Workshop on the Mechanics of Materials and Structures, 2010.

A. Ajdari, S. Babaee, A. Vaziri, "Heterogeneous and functionally graded cellular structures", New England Workshop on the Mechanics of Materials and Structures, 2010.

Jonathan Hammel, A. Ajdari, A. Vaziri, "2D Inplane cylindrical impact on regular hexagonal honeycomb structure: a finite element study", Research, Innovation and Scholarship Expo (RISE 2010), Boston 2010.

A. Vaziri, B. Haghpanah Jahromi, A. Ajdari, "Failure and fracture of shock-loaded metal sandwich panels", Proc. ASME IMECE2010-39923, Vancouver, BC, 2010.

S. Babaee, B.H. Jahromi, A. Ajdari, H. Nayeb-Hashemi, A. Vaziri, "Mechanical properties of open-cell cellular structures with rhombic dodecahedron cells", Proc. ASME IMECE2010-39924, Vancouver, BC, 2010.

B.H. Jahromi, A. Ajdari, H. Nayeb-Hashemi, A. Vaziri, " Linear buckling analysis of cracked cylindrical shell under axial compression ", Proc. ASME IMECE2010-39794, Vancouver, BC, 2010.

A. Vaziri, A. Ajdari, "Homogenization and failure of metal sandwich panels subjected to air shocks", IMPLAST 2010, Providence, RI.

A. Ajdari, S. Babaee, A. Vaziri, "Dynamic crushing and energy absorption of cellular structures", IMPLAST 2010, Providence, RI.

A. Ajdari, B. H. Jahromi, A. Vaziri, "Heterogeneous cellular structures for energy absorption and impact applications", Int. Symp. Plasticity, St. Thomas, Virgin Islands, 2010.

A. Vaziri, A. Ajdari, "Mechanics and dynamics of instability and deformation localization in elastic shells", Proc. ASME IMECE2009-11716, Lake Buena Vista, FL, 2009.

A. Ajdari, B. H. Jahromi, H. Nayeb-Hashemi, A. Vaziri, "Energy absorbance and dynamic strength of regular, irregular and functionally graded cellular structures", Proc. ASME IMECE2009-10539, Lake Buena Vista, FL, 2009.

M.-W. Moon, A. Ajdari, A. Vaziri, "Sculpting on polymers with ion beam/plasma treatment: mechanics and mechanisms", Proc. ASME IMECE2009-10539, Lake Buena Vista, FL, 2009.

A. Ajdari, B.H. Jahromi, H. Nayeb-Hashemi, A. Vaziri, "Dynamic crushing of regular and functionally graded cellular structures", RICC 2009, Northeastern University, Boston, MA 2009.

B.H. Jahromi, A. Ajdari, A. Vaziri, "A numerical method for predicting elasto-plastic response of functionally graded materials", COMPLAS X (Int. Conf. Computational Plasticity), Barcelona, Spain, 2009.

A. Ajdari, B.H. Jahromi, H. Nayeb-Hashemi, A. Vaziri, "Dynamic crushing of regular and functionally graded cellular materials", USNCCM X, Columbus, OH 2009.

B.H. Jahromi, G. H. Farrahi, A. Ajdari, H. Nayeb-Hashemi, A. Vaziri, "Variable materials property method for functionally graded materials", USNCCM X, Columbus, OH 2009.

S.C. Corbett, A. Ajdari, A.U. Coskun, H. Nayeb-Hashemi, "Effect of blood viscosity on thrombosis potential near a step wall transition", Proc. ASME SBC2009-205647, Lake Tahoe, CA, 2009.

A. Ajdari, H. Nayeb-Hashemi, P.K. Canavan, "Mechanical behavior of functionally graded 2-d cellular

structures: A finite element study", Proc. ASME IMECE2008-66206, Boston, MA 2008.

A. Ajdari, P.K. Canavan, H. Nayeb-Hashemi, G. Warner, "Effect of defect on elastic/plastic and creep behavior of bone: a finite element study", Proc. ASME SBC2007-175843, Keystone, CO, 2007.

A. Ajdari, H. Nayeb-Hashemi, P.K. Canavan, "Effect of defect on elastic-plastic and creep behavior of cellular materials", Proc. ASME IMECE2007-42056, Seattle, WA 2007.

A. Ajdari, P.K. Canavan, H. Nayeb-Hashemi, " Effect of defect on elastic/plastic and creep behavior of bone: a finite element study", Research, Innovation and Scholarship Expo (RISE 2006), Boston 2006.

A. Marzban, A. Ajdari, G.M. Warner, P.K. Canavan, H. Nayeb-Hashemi, "The influence of muscle loadings on the density distribution of the proximal femur", Proc. ASME IMECE2006-14996, Chicago, IL, 2006.

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