Vignesh Kannan

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Education

Johns Hopkins University, Baltimore, U.S.A.

Doctor of Philosophy, Mechanical Engineering (*Advisor: Prof. K. T. Ramesh*) *December 2018*
Thesis title: Twinning and the dynamic behavior of magnesium and its alloys

Master of Science in Engineering (M.S.E.), Mechanical Engineering *May 2014*

National Institute of Technology, Tiruchirappalli, India

Bachelor of Technology (B. Tech.), Production Engineering *May 2012*

Focus areas

Continuum mechanics, Materials science, Micro-mechanics and material instabilities, Dynamic behavior of materials, Active materials

Research interests

Experimental Mechanics

- Dynamic behavior of materials: high strain-rate experiments
- Optical measurement techniques and image processing
- In-situ electromechanical experiments

Micromechanics and material instabilities

- Kinetics of micro-scale defects under multi-physical driving fields (viscoplastic deformation and failure, viscoelasticity, ferroelectric switching)
- Localization of deformation across length and time-scales
- Multi-scale material response

Mechanical metamaterials

- Deformation and wave propagation in architectured metamaterials

Research skills

Laboratory skills

- High strain-rate experiments, electromechanical experiments, viscoelastic characterization, high-speed instrumentation (incl. laser interferometry, laser doppler vibrometry)
- *Imaging/microscopy techniques*: In-situ high speed microscopy, digital image correlation, scanning electron microscopy, electron backscattered diffraction microscopy, piezoresponse force microscopy
- *Specimen preparation*: Electro-discharge machining, polishing, lapping, ion milling, sputter coating

Software skills

- *Programming languages:* Matlab (image and data analysis), Python (instrumentation control and automation, image and data analysis), C++
- *Finite Element Analysis:* Abaqus
- *CAD modeling:* Creo, AutoCAD, Solidworks
- *Writing and presentations:* LaTeX

Honors and awards

People's choice best poster award, Mach conference, Annapolis, MD, U.S.A. *April 2017*
Won by popular vote from about 50 researchers working on dynamic behavior of materials
Title: The mechanics of twinning under high strain rates: Dynamics

APS-SCCM student travel award *June 2015 & 2017*
Shock compression of condensed matter topical conference (American Physical Society)

IIT Madras summer fellowship *Summer 2011*
Department of Applied Mechanics, Indian Institute of Technology, Madras
Title: Non-linear analysis of discrete structures- Truss, Beam and Frame
Advisor: Prof. M. S. Sivakumar

Professional service

Peer-reviewer, Journal of Dynamic Behavior of Materials *November 2015*

Extreme arts programme *2016-17*
Hopkins Extreme Materials Institute, Johns Hopkins University

- Interdisciplinary programme designed to bring artists from the Maryland Institute College of Art and scientists together to explore unique perspectives on extreme events
- Collaboration with artist Jay Gould on representation of short time-scale phenomena

Mechanics and Materials graduate seminar *2015-16*
Department of Mechanical Engineering, Johns Hopkins University

- Organizer, weekly student seminar series

Professional membership

Society for Experimental Mechanics (SEM), American Physical Society-Shock Compression of Condensed Matter topical group (APS), Society of Engineering Science (SES)

Mentorship

Graduate students (ETH Zürich)

- Roxanne Rais, MS 2021 *September 2020-current*
  Measuring acoustic wave propagation in architectured metamaterials
- Leila Afilal, MS 2021 *March-December 2020*
  An experiment to measure acoustic wave propagation in thin plates
- Stephan Steiner, MS 2020 *2019-2020*
  Experimental characterization of non-linear viscoelastic materials

Graduate students (Johns Hopkins University)

- Caleb J. Hustedt, MSE 2017 *2015-16*
  In-situ dynamic compression experiments on magnesium and its alloys

Undergraduate students (ETH Zürich)

- Ben Spöttling, BS 2021 *February-May 2020*
  Mapping displacement fields in truss-based metamaterials using digital image analysis

Undergraduate students (Johns Hopkins University)

- Alex Doran, BS 2019 *2017-18*
  Dynamic compression experiments at very high strain-rates using a miniature kolsky bar
- Geordan Gutow, BS 2018 *2016-17*
  Dynamic compression experiments at very high strain-rates using a miniature kolsky bar

Teaching

Johns Hopkins University

Teaching assistant, Mechanical Engineering

- Mechanics-based design (*Instructor:* Prof. K. T. Ramesh) *Spring 2017*
  Sophomore course on the basics of engineering design using mechanics
- Mechanics of solids and materials II (*Instructor:* Prof. J. El-Awady) *Spring 2016*
  Graduate level course on continuum mechanics of solids
- Mechanical engineering freshman lab (*Instructor:* Prof. S. Belkoff) *Spring 2013*
  Undergraduate mechanical engineering laboratory course for freshers

National Institute of Technology, Tiruchirappalli

Workshop instructor, Automotive transmission systems *Summer 2010*

Journal publications (accepted)

- **V. Kannan** et al., The effect of strain rate on the mechanisms of plastic flow and failure of an ECAE AZ31B magnesium alloy, *Journal of Materials Science (2019)*
- D. Mallick, M. Zhao, J. Parker, **V. Kannan** et al., Laser-Driven Flyers and Nanosecond-Resolved Velocimetry for Spall Studies in Thin Metal Foils, *Experimental Mechanics (2019)*
- **V. Kannan**, K. Hazeli *&* K. T. Ramesh, The mechanics of dynamic twinning in single crystal magnesium, *Journal of the Mechanics and Physics of Solids (2018)*
- M. Zhao, **V. Kannan** *&* K. T. Ramesh. The dynamic plasticity and dynamic failure of a magnesium alloy under multiaxial loading, *Acta Materialia (2018)*
- C.J. Hustedt, P. K. Lambert, **V. Kannan** et al., In-situ time resolved measurements of extension twinning during dynamic compression of polycrystalline magnesium, *Journal of Dynamic Behavior of Materials (2018)*
- Lambert et al. Time-resolved x-ray diffraction techniques for bulk polycrystalline materials under dynamic loading, *Rev. Sci. Instruments 85, 093901 (2014)*

Journal publications (under review)

- R. N. Glaesener et al., Viscoelastic truss metamaterials as time-dependent generalized continua, submitted to the *Journal of Mechanics and Physics of Solids*

Journal publications (in preparation)

- **V. Kannan** *&* D. M. Kochmann, Kinetics of ferroelectric switching in poled barium titanate ceramics

Invited presentations

- Kinetics of polarization switching and electromechanical coupling in ferroelectric ceramics, Virtual Symposium on Experimental Mechanics in honor of Prof. K. R. Y. Simha, Indian Institute of Science, Bengaluru, 2020
- Twinning and the dynamic behavior of magnesium and its alloys, Department of Applied Mechanics, Indian Institute of Technology, Madras, 2019

Conference presentations (selected)

- **V. Kannan**, N. Krywopusk, X. Ma, L. Kesckes, T. P. Weihs *&* K.T. Ramesh, The effect of strain-rate on plastic flow and failure of an AZ31B magnesium alloy, *Society for Experimental Mechanics Annual Conference and Exposition, Greenville (2018)*
- **V. Kannan**, K.T. Ramesh *&* K. Hazeli, The mechanics of twinning under high strain-rates: Dynamics, *Mach Conference, Annapolis MD (2017)* ***(Peoples' choice best poster award)***
- K.T. Ramesh, M. Zhao, **V. Kannan**, N. Krywopusk, T.P. Weihs, L. Kesckes *&* C. Williams, Dynamic plasticity in the magnesium alloy AZ31B, *17th International Conference on Experimental Mechanics, Greece (2016)*
- **V. Kannan**, N. Krywopusk, L. Kesckes, T.P. Weihs *&* K.T. Ramesh, Dynamic heterogeneous failures in polycrystalline AZ31B magnesium, *Society for Experimental Mechanics, Orlando, FL (2016)****(International student paper competition finalist)***
- **V. Kannan**, N. Krywopusk, L. Kesckes, D. Casem, T.P. Weihs *&* K.T. Ramesh, Dynamic plasticity in a magnesium alloy: Microstructural *&* continuum effects, *APS Shock Compression of Condensed Matter, Early Career & Student Symposium, Tampa, FL (2015)*

Extra-curricular activities

- Head, Design of transmission systems, BAJA SAE India *2011-12*
  Design, fabrication and testing of All-Terrain Vehicles
- Member, Johns Hopkins University badminton club *2016-2018*
- National Cadet Corps Air wing (B certificate) *2008-09*

Languages

English (fluent), Tamil (native), Hindi (basic), German (beginner)