

Janakiraman (Ram) Balachandran

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RESEARCH INTERESTS

- First principles modeling of thermodynamic, kinetic & transport properties of energy materials.
- Developing material informatics framework that integrates material models, scientific workflows and data analytics tools to accelerate new material discovery.
- Integrating material models of multiple length and time scales to predict material properties.

EDUCATION

- **University of Michigan (UMICH)**, Ann Arbor, MI (Sept 2009 – August 2014)
 - Doctor of Philosophy (Ph.D) in Mechanical Engineering *GPA: 3.80/4.0*
 - *Thesis*: Influence of Material Structure on Thermoelectric Properties of Atomic Scale Systems.
 - *Advisors*: Prof.Vikram Gavini and Prof.Pramod Reddy.
- **National University of Singapore (NUS)**, Singapore (Jan 2008 – July 2009)
 - Master of Engineering (M.Eng) in Mechanical Engineering *GPA: 4.1/5.0*
- **Anna University (Sri Venkateswara College of Engineering)**, India (Jun 2002 – May 2006)
 - Bachelor of Engineering (B.E) in Mechanical Engineering *GPA: 81/100*

RESEARCH POSITIONS

- **Postdoctoral Research Fellow - Oak Ridge National Laboratory** (Jan 2015 — Present)
 - Developing ab-initio models to obtain mechanistic insights on proton transport in perovskite & fluorite materials.
 - Employing those ab-initio models to identify how dopant type, dopant concentration and strain influences proton conductivity in these materials.
 - Developing high throughput scientific workflow and data analytics techniques to identify novel structure-property correlations and new descriptors.
 - Use these new descriptors to develop rational design strategies to design new materials with improved ionic transport properties.
- **Doctoral Program - University of Michigan, Ann Arbor** (Sep 2009 — Aug 2014)
 - Designed and employed state of the art *ab-initio* computational models to quantitatively predict thermoelectric properties of nanoscale systems.
 - More importantly, the computational model elucidated the influence of material structure on these properties. This elucidation provides important insights to experimentalist by interpreting various experimental results in a unified framework.
 - This mechanism also enabled us to develop efficient computational strategies to calculate the aforementioned properties, which has potential for high-throughput calculations.

PUBLICATIONS

- J.Balachandran, P.Reddy, B.D.Dunietz, V.Gavini, “End-Group Influence on Frontier Molecular Orbital Reorganization and Thermoelectric Properties of Molecular Junctions” *J.Phys.Chem.Lett.*, 2013, Vol.4, pp 3825-3833 .

- J.Balachandran, P.Reddy, B.D.Dunietz, V.Gavini, “End-group-induced charge transfer in molecular junctions: effect on electronic-structure and thermopower”, *J.Phys.Chem.Lett.*, 2012, Vol.3(15), pp 1962-1967.
 - A.Tan, J.Balachandran, B.D.Dunietz, S-Y Jang, V.Gavini, P.Reddy, “Length dependence of frontier orbital alignment in aromatic molecular junctions” *Appl.Phys.Lett.*, 2012, Vol.101, 243107 (Joint First Author).
 - A.Tan, J.Balachandran, S.Sadat,V.Gavini, B.D.Dunietz, S-Y Jang, P.Reddy, “Effect of length and contact chemistry on the electronic structure and thermoelectric properties of molecular junctions”, *J.Am.Chem.Soc.*, 2011, 133(23), pp 8838-8841.
 - R.Muthucumarasamy, J.Balachandran, “Mass Transfer Effects on Isothermal Vertical Oscillating Plate in the Presence of Chemical Reaction”, *International Journal of Applied Mathematics and Mechanics*, 2008, Vol. 4(1), pp 66-74.
 - R.Muthucumarasamy, J.Balachandran, “MHD and radiation effects on moving isothermal vertical plate with variable mass diffusion”, *Teorijska I Primenjena Mehanika*, 2006, Vol 33(1), pp. 17-29.
- MANUSCRIPTS UNDER PREPARATION
- J. Balachandran, J.Ding, L.Lin, J.S.Anchell, C.A.Bridges, G.M.Veith, R.R.Unocic, Y.Cheng, W.Ren and P. Ganesh, “Understanding the effects of chemistry and structure on the origin of improved proton conductivity in doped-BaZrO₃”.
 - J. Balachandran, J S. Anchell, C.A.Bridges, G.M.Veith, R.R.Unocic, Y.Cheng, W.Ren, and P. Ganesh, “Nature of proton conduction in disordered proton conducting oxides: A casestudy of Lanthanum Tungstate (La_xW_yO)”.
 - J. Balachandran, L.Lin, J S. Anchell, W.Ren, and P. Ganesh, “High-throughput analysis of proton conductivity in doped perovskites”.
- TEACHING EXPERIENCE
- *Graduate Student Instructor* (ME505-FINITE ELEMENT METHODS, Fall 2011/2012) – Instructed incoming graduate students to write FEM programs in *Matlab* to solve 3D elliptic and parabolic differential equations pertaining to heat conduction and linear elasticity.
 - *Graduate Student Instructor* (ME501- ME505-MATHEMATICAL METHODS IN MECH. ENGG., Fall 2013) – Instructed incoming graduate students in complex analysis, linear vector spaces and differential equations.
 - *Graduate Student Instructor* (ME211- ME211-INTRODUCTION TO SOLID MECHANICS, Winter 2014)– Instructed the ME sophomore students in statics and mechanics of materials.
- HONOURS & AWARDS
- Invited judge in “Ross 3 Minute Thesis” organized by Ross Business School, Summer 2014.
 - Second place in “3 Minute Thesis” organized by Rackham Graduate School, Fall 2013.
 - APS Energy Workshop Travel Grant, U.S Department of Energy, March 2013 and March 2014.
 - Department of Mechanical Engineering Fellowship (Fall 2009).
 - *Innovative Student Project Award 2006*, from Indian National Academy of Engineering.
- CONFERENCE AND WORKSHOPS
- Proton Conducting Oxides - A case study of disordered Fluorites, *Spallation Neutron Source, ORNL, User Meeting*, TN, Oct 2015.
 - Discovery, Validation & Insights of Proton Transport in Solid Electrolytes, *Center for Nanophase Material Sciences, ORNL, User Meeting*, TN, Sep 2015.
 - End-group Influence on the Frontier Molecular Orbital Reorganization in Molecular Junctions – Effect on Thermopower, *American Physical Society*, CO, Mar 2014.
 - Tailoring the thermopower and nature of transport in aromatic molecule-metal junctions through end-groups, *American Chemical Society*, IN, Sept 2013.

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- Effect of Stabilization and End Group Induced Charge Transfer on Frontier Molecular Orbital Reorganization, *American Physical Society*, MD, Mar 2013.

PROFESSIONAL
AND
VOLUNTEER
EXPERIENCE

- *Reviewer* – for journals (i) Journal of Materials Chemistry C, (ii) RSC Advances, (iii) Journal of Physics & Chemistry of Solids.
- *Member, Engineering Graduate Symposium* (Fall 2013) – Initiated a collaborative interaction between the College of Engineering graduate students, the university's Center for Entrepreneurship and the Ann Arbor startup companies through the annual EGS event.
- *Representative, Rackham Student Government* (Jan-Dec 2013) – Drafted a resolution to make the course evaluations available to all students for improving the academic transparency. Coordinating with the registrar office to ensure the course evaluations are made available to students in an accurate, systematic and sustainable way.

REFERENCES

- Dr. Bobby G. Sumpter, Deputy Director, Center for Nanophase Material Sciences, Oak Ridge National Laboratory, Oak Ridge, sumpterbg@ornl.gov
- Dr. Vikram Gavini, Associate Professor, University of Michigan, Ann Arbor, vikramg@umich.edu
- Dr. Panchapakesan Ganesh, Research and Development Staff Scientist, Oak Ridge National Laboratory, Oak Ridge, ganeshp@ornl.gov
- Dr. Pramod Reddy, Associate Professor, University of Michigan, Ann Arbor, pramodr@umich.edu
- Dr. Emmanouil Kioupakis, Assistant Professor, University of Michigan, Ann Arbor, kioup@umich.edu
- Dr. Krishna Garikipati, Professor, University of Michigan, Ann Arbor, krishna@umich.edu