

Harkirat Singh

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| CONTACT INFORMATION | Solid Mechanics Brown University Barus and Holley, 184 Hope street Providence, RI 02906. | Homepage: www.harkirat-singh.com Email: harkirat_singh@brown.edu |
| RESEARCH INTERESTS | Computational Mechanics | |
| EDUCATION | Brown University <i>Ph.D.</i> in Solid Mechanics <i>MS</i> in Solid Mechanics | 2018 - present 2018 |
| | Indian Institute of Technology (IIT), Kanpur <i>Bachelor's and Master's (Dual degree)</i> in Mechanical Engineering | 2016 |
| RESEARCH EXPERIENCE | Graduate Student Researcher Advisor: Prof. David Henann Solid Mechanics, <i>Brown University</i> | 2018 - present |
| | Research Assistant Advisor: Prof. Venkatesan Department of Aerospace, <i>IIT Kanpur</i> | 2016-17 |
| | Research Assistant Advisor: Prof. Pankaj Wahi Mechanics & Applied Mathematics Group, <i>IIT Kanpur</i> | 2015-16 |
| TECHNICAL SKILLS | <i>Computational:</i> Finite element analysis, Structural analysis, Numerical methods, Molecular dynamics. <i>Programming languages:</i> MATLAB, Python, Fortran, C. <i>Softwares:</i> Abaqus, LAMMPS, Mathematica, Ovito, Maple. | |
| PHD THESIS | Constitutive modeling for size segregation and flow in granular materials (May' 18 - Present) <ul style="list-style-type: none">Developed continuum scale model that predicts segregation and flow simultaneouslyDeveloped finite deformation elasto-plastic framework coupled with segregation dynamicsImplemented the numerical framework using Abaqus user element (UEL)Used Abaqus python scripting to automate several pre/post- processing operations Discrete element method (DEM) modeling for dense granular mixtures (May' 18 - Present) <ul style="list-style-type: none">Formulated grain level interactions to perform particle simulationsStudied diverse boundary-driven and gravity-driven flows by performing numerically integration using LAMMPSDeveloped coarse-graining methods to map microscopic-macroscopic information Pressure sensitive shear zones in hydrogel suspensions (May' 22 - Present) <i>Collaborators:</i> Zohreh Farmani and Joshua Diksmen, Wageningen University. Nazanin Ghods, TU Graz <ul style="list-style-type: none">Implemented nonlocal granular rheology model using Abaqus UEL subroutineStudied the shear localization in hydrogel suspensions in a boundary-driven flow geometryModel performance is tested against MRI-PIV measurements and DEM simulations | |
| MASTERS THESIS | Modeling the dynamics of the string vibrating against a rigid obstacle (May '15 - Jul '16) <ul style="list-style-type: none">Derived the equations of motion for the system using extended Hamilton's principlePerformed reduced order modeling using Galerkin projection methodPerfomed stability anaylsis of equations with periodic coefficients using Floquet theory | |

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| SELECTED PROJECTS | Torsional properties of beams with arbitrary cross section (Sep'16 - April'17) | |
| | <ul style="list-style-type: none"> Studied the discrepancy in torsional frequency of I-beams between FEM and analytical solutions Developed series solutions estimating the torsional rigidity of beams with arbitrary cross-section | |
| | Exam schedule optimization (Jan'15 - May'15) | |
| | <ul style="list-style-type: none"> Formulated a well posed linear programming problem with an objective to optimize the exam schedule given number of days, preference of students with other soft and hard constraints. | |
| CONFERENCES | Society of Engineering Science (SES) Annual Meeting, Texas, US. <i>Talk</i> . | 2022 |
| | Gordan Reserch Conference, Granular Matter, Stonehill college, US. <i>Poster</i> . [Poster] | 2022 |
| | American Physics Society (APS) March Meeting, Chicago, US. <i>Talk</i> . [Link] | 2022 |
| | Society of Engineering Science (SES) Annual Meeting. <i>Virtual</i> . [Poster] | 2021 |
| | 9th European Nonlinear Dynamics Conference, Budapest, Hungary. <i>Talk</i> . [Paper] | 2017 |
| | International Congress of Theoretical and Applied Mechanics , Montreal, Canada. [Poster] | 2016 |
| | International Conference on Structural Nonlinear Dynamics and Diagnosis, Marrakesh, Morocco. <i>Talk</i> . [Paper] | 2016 |
| | International Conference on Advances in Dynamics, Vibrations and Control, NIT Durgapur, India. <i>Talk</i> . [Paper] | 2016 |
| JOURNAL PUBLICATIONS | Harkirat Singh and Pankaj Wahi. <i>Non-planar vibrations of a string in the presence of a boundary obstacle</i> . Journal of Sound and Vibration, 389, 326-349. [PDF] | |
| | Harkirat Singh and Pankaj Wahi. <i>Role of curvatures in determining the characteristics of a string vibrating against a doubly curved obstacle</i> . Journal of Sound and Vibration, 402, 1-13. [PDF] | |
| WORKING PAPERS | <i>Pressure sensitive non-local behaviour in hydrogel suspension</i> , with Zohreh Farmani and Nazanin Ghods | |
| | <i>A predictive continuum model for coupled size segregation and flow in dense granular materials</i> , with Daren liu and David Henann. | |
| | <i>Finite element implementation of segregation dynamics coupled with nonlocal granular rheology</i> , with Shihong Li and David Henann | |
| AWARDS / HONORS | Poster award at SES conference | 2021 |
| | President Fellowship at Brown University | 2017-20 |
| | 4 year Doctoral fellowship at UBC (*not pursued) | 2017 |
| | Cambridge India Ramanujan Scholarship (*not pursued) | 2017 |
| TEACHING EXPERIENCE | Teaching assistant for Advanced Solid Mechanics (ENGN 1750) | (Sep '20 - Dec '20) |
| | Teaching assistant for Mechanics of Solids and Structures (ENGN 0310) | (Sep '19 - Dec '16) |
| RELEVANT COURSES | Continuum Mechanics Computational Mechanics Fracture Mechanics Non-Linear Vibration | Solid Mechanics Plasticity Stress Waves in Solids Aeroelasticity |
| REFERENCE | David Henann | Email: david.henann@brown.edu |
| | Professor, Solid Mechanics, Brown University | |
| | Pradeep Guduru | Email: pradeep.guduru@brown.edu |
| | Professor, Solid Mechanics, Brown University | |
| | Daniel Harris | Email: daniel.harris3@brown.edu |
| | Professor, Fluid Mechanics, Brown University | |