Curriculum Vitae

of

Dr. Vikranth Racherla, Professor, ME, IIT Kharagpur

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Mechanical Engineering
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Education

UNIVERSITY OF PENNSYLVANIA
PhD in Mechanical Engineering and Applied Mechanics, May 2007
PhD Title: Non-associated plastic flow and effects on macroscopic failure mechanisms

INDIAN INSTITUTE OF TECHNOLOGY, MADRAS
B. Tech. in Mechanical Engineering, May 2002

Research Experience

Professor, IIT KHARAGPUR

- Developed fluid filled porous flexible abrasive foams for superfinishing applications
- Developed analytical models for understanding mechanical behavior of fluid filled foams
- Designed and developed a multi-axial loading setup for testing railway suspension elements

Associate Professor, IIT KHARAGPUR

- Designed a six degree of freedom rail-wheel contact simulator for experimental investigation of traction-slip characteristics, wheel wear, rolling contact fatigue, and wheel-rail contact noise
- Developed metro coach vehicle dynamics models and conducted instrumented field trials on Kolkata east-west metro corridor to validate the models
- Developed a rapid, cost-effective solid-state sintering process that can be carried out on CNC milling or friction stir welding machines. Fabricated open-cell copper foam with different microstructures and shapes and sizes using this process. An Indian patent for the process has been filed

Assistant Professor, IIT KHARAGPUR

- Designed and developed a combined tension-torsion creep testing machine and characterized railway wheel steel on this machine

- Determined heat partitioning at wheel-brake block interface in railway wheels using a two-dimensional boundary element formulation
- Conducted wheel gauge failure analyses on locomotive and coach wheel sets using finite element analyses and field data
- Developed finite element formulations for laser forming
- Investigated effect of post weld aging, backing plate, and process parameters on weld quality of friction stir welded naturally aged 6063 aluminum alloy

Post Doc, ECOLE POLYTECHNIQUE

- Investigated overall behavior, microstructure evolution, and onset of macroscopic instabilities of shear band type in thermoplastic polymers, made up of hard and soft phases that self separate on length scales of tens of nanometers, using a nonlinear homogenization scheme
- Computed effective conductivity of nonlinear, random, isotropic polycrystals using a homogenization scheme

Graduate Research Assistant, UNIVERSITY OF PENNSYLVANIA

- Performed multi-scale analyses to link atomistic simulations to polycrystalline plasticity in transition metals such as Molybdenum and Tungsten
- Proposed new constitutive models for transition metals based on multi-scale analyses, and used them to investigate necking, cavitation, and fracture in these materials
- Discovered instabilities that lead to non-uniform thinning of sheets in these materials through analyses in ABAQUS

Courses Taught

- Design of Machine Elements (ME30602), UG Core
- Continuum Mechanics (ME60413), PG Elective
- Fracture Mechanics (ME60434), PG Elective
- Mechanics (ME10001), UG Core
- Finite and boudary element methods in manufacturing (ME60131), PG Elective
- Numerical modeling of manufacturing processes (ME60134), PG Elective

PhD Guidance

1) *Student Name*: Vakkalagadda MR Kumar (11ME91R04)
   Thesis Title: Locomotive wheel failure from excessive wheel gauge change
   Supervisor(s): Dr. V Racherla
2) *Student Name*: Vineesh KP (12ME91P01)
   Thesis Title: Gauge widening failure of tread-braked passenger coach wheel sets: Finite element modeling and field observations
   Supervisor(s): Dr. V Racherla

3) *Student Name*: SS Chakraborty (10ME90E12)
Thesis Title: Experimental and numerical analyses of bent angle modification and three dimensional surface generation by laser forming
Supervisor(s): Dr. AK Nath, Dr V Racherla

4) *Student Name*: M Imam (09ME9421)
Thesis Title: Studies on friction stir welding of naturally aged 6063 AA
Supervisor(s): Dr. V Racherla, Dr. K Biswas

5) *Student Name*: B Venkateshwarlu (09ME9414)
Thesis Title: Microstuctural and Tribological Study of Nanostructured and Conventional Thermally Sprayed Ceramic Coatings
Supervisor(s): Dr. V Racherla, Dr PP Bandyopadhyay

Sponsored Research Projects (as Principal Investigator)

1) *Project Name*: Bogie design, vehicle dynamics and rail - wheel traction control towards improved safety and comfort and reduction in running costs for metro coaches
Sponsoring Agencies: MHRD, Urban Development Ministry, BEML
Duration: 1-11-2016 to 31-10-2021

2) *Project Name*: Design and development of an electric pickup truck with emphasis on passively cooled, balanced battery pack design for maximizing range and battery pack life
Sponsoring Agency: TCG Foundation
Duration: 1-4-2018 to 21-3-2021

3) *Project Name*: Design and development of aerodynamic body panels and light - weight structures for next generation electric vehicles
Sponsoring Agency: IDBI Trusteeship Services Ltd.
Duration: 10-2-2020 to 9-2-2022

4) *Project Name*: Design of high power rated battery packs for electric vehicles with effective thermal and stress management strategies for enhanced safety and performance
Sponsoring Agency: IIT Kharagpur (Challenge Grant)

5) *Project Name*: Design and fabrication of an electric rickshaw with enhanced safety, performance and ride comfort
Sponsoring Agency: IIT Alumni
Start Date, Duration: 1-10-2016 to 30-9-2018

6) *Project Name*: Static and fatigue analysis of bogie frame
Sponsoring Agency: Bharat Earth Movers Limited (BEML)
Duration: 1-5-2016 to 31-10-2017

7) *Project Name*: Creep and warping (including gauge widening) analysis of hot-running loco wheels towards development of design guidelines against gauge widening
Sponsoring Agency: RDSO, Ministry of Railways
Duration: 15-2-2012 to 14-8-2015

8) *Project Name*: Optimal design of human muscle like electroactive polymer actuators
Sponsoring Agency: DST, Government of India
Duration: 20-8-2010 to 31-10-2013

9) *Project Name*: Optimal design of tough wear resistant nanostructured coatings
Sponsoring Agency: ISIRD, SRIC, IIT Kharagpur
Duration: 1-9-2010 to 31-10-2013

Consultancy Projects (as Principal Investigator)

1) *Project Name*: Design analysis of 30 kW permanent magnet alternator
Sponsoring Agency: Signotron India Pvt. Ltd.
Duration: 29.4.2019 to 18.4.2020

2) *Project Name*: Development of composite integral armour of futuristic infantry combat vehicles
Sponsoring Agencies: Ordnance Factory Medak
Duration: 1-2-2016 to 31-8-2017

3) *Project Name*: Stability and structural analysis of 180 KVA converter
Sponsoring Agency: Signotron India Pvt. Ltd.
Duration: 21-9-2015 to 30-11-2015

4) *Project Name*: Simulation of sheet rolling to improve uniformity in through thickness properties of rolled sheets
Sponsoring Agency: Tata Steel Limited
Duration: 20-6-2015 to 30-9-2016

5) *Project Name*: Failure of alternator shaft key and bearings
Sponsoring Agency: Signotron India Pvt. Ltd.
Duration: 1-9-2015 to 31-3-2016

6) *Project Name*: Design and analyses of roller entry guides
Sponsoring Agency: Tata Steel Limited
Duration: 1-9-2013 to 1-6-2014

7) *Project Name*: Training on rolling mill simulation
Sponsoring Agency: Tata Steel Limited
Duration: 1-1-2013 to 1-3-2013

8) *Project Name*: Application of finite element and other analytical methods for failure analyses of roller bearings
Sponsoring Agency: ABC Bearings Limited
Duration: 15-1-2012 to 15-1-2013

9) *Project Name*: Support and training on trommel design
Sponsoring Agency: Tega Industries Limited
Duration: 1-12-2011 to 1-12-2012

10) *Project Name*: Demonstration of and advice on finite element analysis of elastic-plastic structures
Sponsoring Agency: Usha Martin Limited
Duration: 15-9-2010 to 30-9-2010

11) *Project Name*: Demonstration of finite element analyses towards design of cradles
Sponsoring Agency: Signotron India Pvt. Ltd.
Duration: 23-3-2011 to 30-3-2011

Patents

1) *Inventors*: V Racherla, VM Sharma, SK Pal.
Patent Title: A system for fabrication of bonded metal foam metal sandwich structures and process thereof.
Indian Patent Application Number: 20203106609 dated April 17, 2020
Assignee: IIT Kharagpur

2) *Inventors*: V Racherla, VM Sharma, SK Pal.
Patent Title: A system for solid-state sintering of hollow metallic cylindrical components and a method of such sintering.
Indian Patent Application Number: 202031006307 dated Feb 13, 2020
Assignee: IIT Kharagpur

3) *Inventors*: KK Parajapati, V Racherla
Patent Title: Reconfigurable mechanical testing machine capable of applying monotonic or cyclic bi-axial, tension-torsion and compression-torsion loadings.

Indian Patent Application Number: 202031002256 dated Jan 18, 2020
Assignee: IIT Kharagpur

4) *Inventors*: KVS Prakash, KK Parajapati, V Racherla
Patent Title: Six degrees of freedom rail-wheel contact simulator with speed and torque control using motor-generator set up with common DC bus for efficient operation .
Indian Patent Application Number: 202031002223 dated Jan 17, 2020
Assignee: IIT Kharagpur

5) *Inventor:* A Chattopadhyay, G Muvvala, S Sarkar, A Sadhu, V Racherla, A K Nath
Patent Title: Direct Additive Laser Welding of Dissimilar Materials.
Indian Patent Application Number: 202031000073 dated Jan 1, 2020
Assignee: IIT Kharagpur

6) *Inventors*: J Chatterjee, A Mohan, V Racherla, V Dixit
Patent Title: Frequency reconfigurable slot antenna using metasurface for cognitive radio applications
Indian Patent Application Number: 201931043582 dated Oct 25, 2019.
Assignee: IIT Kharagpur

7) *Inventors*: V Racherla, RK Naik, SK Panda
Patent Title: Metal sandwich panels
Indian Patent Application Number: 201931018704 dated May 10, 2019.
Assignee: IIT Kharagpur

8) *Inventors*: V Racherla, VM Sharma, SK Pal.
Patent Title: Add-on kit for doing cost effective, energy efficient, rapid, solid-state friction sintering on vertical milling/drilling/friction stir welding machines.
Indian Patent Application Number: 201731037839 dated 25.10.2017
Assignee: IIT Kharagpur

9) *Inventor*: V Racherla
Patent Title: An evaporative cooling arrangement and a water absorbent coating composition
Indian Patent Application Number: 201831018199 dated 15-5-2018
Assignee: IIT Kharagpur

10) *Inventors*: V Racherla, S Dashmahapatra, T Moharana, B Paul
Patent Title: Trommel assembly having a spiral assembly with decaying pitch
US Patent Application Number: US20160129477A1 dated 2013-05-09
Assignee: IIT Kharagpur, Tega Industries

11) *Inventor:* V Racherla
Patent Title: Spacer for use in taper roller or angular contact bearings
Indian Patent Application Number: 499/KOL/2013 dated May 01, 2013
Assignee: IIT Kharagpur

12) *Inventors*: V Racherla, Vineesh KP
Patent Title: Cost-effective mechanical testing equipment for characterizing creep behavior of materials under combined tension-torsion loadings
Indian Patent Application Number: 1263/KOL/2012 dated 02-11-2012
Assignee: IIT Kharagpur

Publications in Refereed International Journals

1) RK Naik, SK Panda, V Racherla. A new method for joining metal and polymer sheets in sandwich panels for highly improved interface strength. *Composite Structures* 251 (2020), DOI: 10.1016/j.compstruct.2020.112661
2) Sharma V M, S K Pal, V Racherla. A new sintering method for fabrication of open-cell metal foam parts. Materials and Manufacturing Processes (2020). DOI: 10.1080/10426914.2020.1784933
3) A Chattopadhyaya , G Muvvalaa, S Sarkara, V Racherla, AK Nath, Effect of laser shock peening on microstructural, mechanical and corrosion properties of laser beam welded commercially pure titanium. Optics and Laser Technology, DOI: 10.1016/j.optlastec.2020.106527
4) Vineesh K P, Vakkalagadda M R K, Dev M, Rao B K, V Racherla. Effect of periodic wheel tread reprofiling on wheel gauge evolution in the wheelsets of tread-braked coaches: Finite element modeling and field observations. *Proceedings of the institution of mechanical engineers, Part F: Jouranl of Rail and Rapid Transport* (2019), 234 (6) (2019), 678-686.
5) Sharma V M, V Racherla and S K Pal. Synthesis of open-cell copper foam using friction sintering. *The International Journal of Advanced Manufacturing Technology* 103 (5-8) (2019), 3163-3174.
6) VM Sharma, V Racherla, SK Pal. Friction sintering of brass powder. *Advances in Materials and Processing Technologies* (2018), 1-9.
7) SS Chakraborty, V Racherla, AK Nath. Thermo-mechanical finite element study on deformation mechanics during radial scan line laser forming of a bowl shaped surface out of a thin sheet. *Journal of Manufacturing Processes* 31 (2018), 593-604.
8) KP Vineesh, MRK Vakkalagadda, M Dev, BK Rao, V Racherla. Gauge widening of passenger coach wheel sets in Indian Railways: Observed statistics and failure analysis. *Engineering Failure Analysis* 71 (2017), 105-119.

9) M Imam, V Racherla, K Biswas, H Fujii, V Chintapenta, Y Sun, Y Morisada. Microstructure-property relation and evolution in friction stir welding of naturally aged 6063 aluminium alloy. *The International Journal of Advanced Manufacturing Technology* 91 (5-8) (2017), 1753-1769.
10) V Bolleddu, V Racherla, PP Bandyopadhyay. Characterization of air plasma-sprayed yttria-stabilized zirconia coatings deposited with nitrogen. *The International Journal of Advanced Manufacturing Technology* 90 (9-12) (2017), 3437-3449.
11) V Bolleddu, V Racherla, PP Bandyopadhyay. Comparative study of air plasma sprayed and high velocity oxy-fuel sprayed nanostructured WC-17wt% Co coatings. *The International Journal of Advanced Manufacturing Technology* 84 (5-8) (2016), 1601-1613.
12) KP Vineesh, MRK Vakkalagadda, AK Tripathi, A Mishra, V Racherla. Non-uniformity in braking in coaching and freight stock in Indian Railways and associated causes. *Engineering Failure Analysis* 59 (2016), 493-508.
13) MRK Vakkalagadda, KP Vineesh, A Mishra, V Racherla. Locomotive wheel failure from gauge widening/condemning: Effect of wheel profile, brake block type, and braking conditions. *Engineering Failure Analysis* 59 (2016), 1-16.
14) MRK Vakkalagadda, KP Vineesh, A Mishra, V Racherla. Locomotive wheel failure from gauge widening/condemning: Finite element modeling and identification of underlying mechanism. *Engineering failure analysis* 57 (2015), 143-155.
15) MRK Vakkalagadda, DK Srivastava, A Mishra, V Racherla. Performance analyses of brake blocks used by Indian Railways. *Wear* 328 (2015), 64-76.
16) MRK Vakkalagadda, KP Vineesh, V Racherla. Estimation of railway wheel running temperatures using a hybrid approach. *Wear* 328 (2015), 537-551.
17) SS Chakraborty, K Maji, V Racherla, AK Nath. Investigation on laser forming of stainless steel sheets under coupling mechanism. Optics & Laser Technology 71 (2015), 29-44.
18) SS Chakraborty, H More, V Racherla, AK Nath. Modification of bent angle of mechanically formed stainless steel sheets by laser forming. *Journal of Materials Processing Technology* 222 (2015), 128-141.
19) M Imam, V Racherla, K Biswas. Effect of backing plate material in friction stir butt and lap welding of 6063-T4 aluminium alloy. *The International Journal of Advanced Manufacturing Technology* 77 (9-12) (2014), 2181-2195.
20) M Imam, V Racherla, K Biswas. Effect of post-weld natural aging on mechanical and microstructural properties of friction stir welded 6063-T4 aluminium alloy. *Materials and Design* 64 (2014), 675-686.
21) V Bolleddu, V Racherla, PP Bandyopadhyay. Microstructural and tribological characterization of air plasma sprayed nanostructured alumina–titania coatings

deposited with nitrogen and argon as primary plasma gases. *Materials & Design* 59 (2014), 252-263.

22) V Bolleddu, V Racherla, PP Bandyopadhyay. Microstructural characterization of plasma sprayed conventional and nanostructured coatings with nitrogen as primary plasma gas. *Surface and Coatings Technology* 235 (2013), 424-432.
23) M Imam, K Biswas, V Racherla. On use of weld zone temperatures for online monitoring of weld quality in friction stir welding of naturally aged aluminium alloys. Materials & Design 52 (2013), 730-739.
24) M Imam, K Biswas, V Racherla. Effect of weld morphology on mechanical response and failure of friction stir welds in a naturally aged aluminium alloy. Materials & Design 44 (2013), 23-34.
25) V Racherla. Colossal dielectric constant polymer nanocomposites: Role of charge injection at matrix–filler interfaces. *Journal of Composite Materials* 47 (19) (2013), 2353-2360.
26) SS Chakraborty, V Racherla, AK Nath. Parametric study on bending and thickening in laser forming of a bowl shaped surface. *Optics and Lasers in Engineering* 50 (11) (2012), 1548-1558.
27) PP Bandyopadhyay, Didier Chicot, B Venkateshwarlu, V Racherla, Xavier Decoopman, Jacky Lesage. Mechanical properties of conventional and nanostructured plasma sprayed alumina coatings. *Mechanics of Materials* 53 (2012), 61-71.
28) V Racherla. An electromechanical model for characterizing sensing and actuating performance of unimorphs based on "plain" dielectric polymers. *Sensors and Actuators A: Physical* 168 (2) (2011), 343-350.
29) JL Bassani, V Racherla. From non-planar dislocation cores to non-associated plasticity and strain bursts. *Progress in Materials Science* 56 (6) (2011), 852-863.
30) V Racherla, O Lopez-Pamies, PP Castañeda. Macroscopic response and stability in lamellar nanostructured elastomers with "oriented" and "unoriented" polydomain microstructures. *Mechanics of Materials* 42 (4) (2010), 451-468.
31) R Gröger, V Racherla, JL Bassani, V Vitek. Multiscale modeling of plastic deformation of molybdenum and tungsten: II. Yield criterion for single crystals based on atomistic studies of glide of 1/2< 111> screw dislocations. Acta Materialia 56 (19) (2008), 5412-5425.
32) V Racherla, PP Castañeda. Linear comparison estimates for the effective resistivity of three-dimensional nonlinear polycrystals. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* 464 (2008), 2391-2410.
33) V Racherla, JL Bassani. Strain burst phenomena in the necking of a sheet that deforms by non-associated plastic flow. *Modelling and Simulation in Materials Science and Engineering* 15 (1) (2007), S297-S311.

34) V Vitek, M Mrovec, R Gröger, JL Bassani, V Racherla, L Yin. Effects of non-glide stresses on the plastic flow of single and polycrystals of molybdenum. *Materials Science and Engineering: A* 387 (2004), 138-142

Publications in International Conference

1) HG Danawe, SK Singh, V Racherla. Behaviour of metro coach on newly built track in kolkata, *ASME/IEEE Joint Rail Conference* 2020, *6 pages.* DOI: 10.1115/JRC2020-8080.
2) SK Singh, HG Danawe, V Racherla, SR Singh, A Prasad. Ride index for metro coaches, *ASME International Mechanical Engineering Congress and Exposition* 2019, *5 pages.* DOI: 10.1115/IMECE2019-11128.
3) Friction sintering of copper powder using a new rapid, cost effective and energy efficient process. *ASME 2018 13th International Manufacturing Science and Engineering Conference, College Station, Texas, USA, June 18–22, 2018, 8 pages.*
4) VM Sharma, D Maity, V Racherla, SK Pal. Friction sintering of copper powder using a new rapid, cost effective and energy efficient process. *ASME 2018 13th International Manufacturing Science and Engineering Conference, College Station, Texas, USA, June 18–22, 2018, 8 pages.*
5) A Chattopadhyay, G Muvvala, V Racherla, AK Nath. A study on laser welding of titanium and stainless steel. *ASME 2018 13th International Manufacturing Science and Engineering Conference, College Station, Texas, USA, June 18–22, 2018, 9 pages.*
6) SS Chakraborty, V Racherla, AK Nath. Investigation on deformation mechanism in laser forming of a bowl shaped surface out of a flat circular thin sheet using circular scan. *Proceedings of 10th International Conference Precision, Meso, Micro and Nano Engineering (COPEN 10), IIT Madras, Chennai, India, December 7-9, 2017, 4 pages.*
7) KP Vineesh, MRK Vakkalagadda, V Racherla. Gauge widening/condemning of parabolic profile locomotive wheels while braking with composite brake blocks. *Sixth International Congress on Computational Mechanics and Simulation, IIT Bombay, India, June 27–July 1, 2016, 7 pages.*
8) SS Chakraborty, R Kataruka, YK Madhukar, V Racherla, AK Nath. Investigation on 3D laser forming of AISI 304 sheet using coupling and upsetting mechanisms. *Twenty Third International Conference on Processing and Fabrication of Advanced Materials XXIII, IIT Roorkee, India, December 5-7, 2014, 10 pages.*

9) MRK Vakkalagadda, V Racherla. Heat partition analyses for tread braking on railway wheels, *5th International Congress on Computational Mechanics and Simulation, Chennai, India, December 10-13, 2014, 4 pages.*

10) SS Chakraborty, K Maji, V Racherla, AK Nath. Study on the effect of Fourier number in laser forming of AISI 304 stainless steel sheet under coupling mechanism using finite element simulations and experiments. *International Conference on Precision, Meso, Micro and Nano Engineering COPEN-8, NIT Calicut, December 13-15, 2013, 6 pages.*

11) MRK Vakkalagadda, V Racherla. Train dynamics model for analyzing heat dissipation in locomotive and wagon wheels. *International Conference on Computer Aided Engineering (CAE-2013), Department of Mechanical Engineering, IIT Madras, India, December 19-21, 2013, 5 pages.*

12) M Imam, V Racherla, K Biswas. Evaluation of weld quality through online temperature monitoring in friction stir welds of AA 6063-T4. *The Second International Conference on Intelligent Robotics, Automation and Manufacturing (IRAM-2013), IIT Indore, India*, *December 16-18, 2013, 15 pages.*

13) M Imam, V Racherla, K Biswas. Weld zone modeling in friction stir welds in AA 6063-T4. *Fourth International Congress on Computational Mechanics and Simulation, IIT Hyderabad, India, December 9-12, 2012, 8 pages.*

Publications in Indian Conferences

1) KP Vineesh, MRK Vakkalagadda, DK Srivastava, A Misra, V Racherla. Analyses of temperatures in locomotive wheels fitted with cast iron and composite brake blocks. *Indian Conference on Applied Mechanics (INCAM), IIT Delhi, Delhi, India, July 13-15, 2015*, *6 pages.*

2) KP Vineesh, MRK Vakkalagadda, V Racherla. Prediction and validation of temperatures of locomotive wheel subjected to tread braking. *23rd National Heat and Mass Transfer Conference and 1st International ISHMT-ASTFE Heat and Mass Transfer Conference IHMTC2015, Liquid Propulsion Systems Centre, ISRO, Thiruvananthapuram, India, December 17-20, 2015, 8 pages.*

3) SS Chakraborty, V Racherla, AK Nath, "Comparison of circular and radial scan strategy for making a bowl shaped surface by laser forming", *DAE-BRNS National Laser Symposium (NLS-22), Manipal University, India, January 8-11, 2014, 4 pages.*

Awards and Fellowships

- Graduate Research Fellowship, University of Pennsylvania, 2002 – 2006
- Gandhian Young Technological Innovation Appreciation (GYTI) Award – 2016