

Sethurao Gururaja, PhD(BITS-Pilani), Postdoc(ANRF-NPDF@IIT-B)

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Brief Overview: A highly motivated researcher specializing in AI/ML-driven predictive modeling and machine adaptation for manufacturing systems. Currently, I am a National Postdoctoral Fellow at IIT-B under the ANRF-NPDF scheme. I hold a Ph.D. from BITS Pilani, Hyderabad, where I developed intelligent solutions for real-time failure prediction using machine learning and sensor integration. My work includes three patents (1 granted, 2 filed) and multiple research excellence awards. I have developed AI-based real-time monitoring systems and reinforcement learning models for failure detection and process optimization, making significant contributions to smart manufacturing and predictive maintenance.

Education:

- National Postdoctoral Fellow at IIT-Bombay under **ANRF-NPDF Scheme**. Mentor: **Prof. Ramesh K Singh**
- Ph.D. in AI/ML for Manufacturing (BITS-Pilani, Hyderabad) – 9.00 CGPA (90.0%) (2025) – **Excellence in Research Award** (2024) and **Outstanding PhD Thesis Award** (2025). Supervisor: **Prof. Kundan K Singh**
- M.Tech in Machine Design (UBDTCE, Davangere) – 80% (2016). Supervisor: The late **Prof. C S Venkatesha**
- B.E. in Mechanical Engineering (PES College of Engineering) – 92.80% (9.28 CGPA) (2014) – IV Rank in the Dept.

Experience:

1. Currently pursuing independent research at **IIT Bombay** in the domain of direct energy deposition of metals.
2. Served as Visiting Faculty at BITS-WILP in the Smart Manufacturing division from June 2025 to Dec 2025.
3. Research Scholar in the department of mechanical engineering at BITS-Pilani, Hyderabad campus from Nov 2020 to Feb 2025.
4. Assistant Professor at Vidyavardhaka College of Engineering, Mysuru, from July 2016 to November 2020.
5. Project Assistant under “Prof. Somashekhar S Hiremath” in “Precision Engineering and Instrumentation Lab (PEIL), IIT-Madras” in the micro-machining area from June 2015 to July 2016.

Patents and Copyrights:

1. An Indian patent titled “Novel Flexible Support Structure For Automated Tap Testing of Static/Rotating Structures” has been **granted**. The design award/grant number is 457458-001 dated 02-05-2025.
2. An Indian patent titled “Contact Detection Method for Enhanced Precision in Mechanical Micromilling Operations” has been **filed**. The application number is, 202411096126.
3. An Indian patent titled “A Novel Method for Farm Level Processing of Tomatoes” have been **published** on 04.09.2020 in the Patent Office Journal No. 36/2020, pp. 37147 (App No.202041036344A). We are waiting for the official evaluation for granting.

Areas of Interest:

Metal/Poly Additive Manufacturing, Applications of AI/ML in Manufacturing, Simulation of Manufacturing Processes, IoT enabled Manufacturing, Digital Manufacturing, Hybrid Manufacturing, Micromachining, Dynamic Stability Modelling, Cutting Tool Dynamics, and Structural Condition Monitoring.

Technical Skills:

AutoCAD (Proficient), SolidWorks (Proficient), Hypermesh (Proficient), Abaqus (Proficient), ANSYS- APDL and Fluent (Proficient), C++ (Novice), Python (Proficient), MATLAB – Signal and Image Processing (Proficient), FORTRAN (Novice), GT Suite (Novice).

Professional Internship:

1. Completed a year-long project assistantship in **IIT-Madras** under **Prof. Somashekhar S Hiremath** in PEIL Lab from June 2015 to June 2016.

Ph.D. Dissertation and Contributions:

- Research Focus: Developing machine learning-based predictive models for dynamic stability analysis and surface form error estimation in high-speed micromilling of thin-walled Ti6Al4V structures.
- Industry Relevance: Addressed machining challenges in aerospace, biomedical, and electronics industries, including reduced stiffness, chatter vibrations, and dimensional inaccuracies.
- Experimental Analysis:
 - Conducted experimental modal analysis (EMA) to determine the dynamic properties of the cutting tool and workpiece.

- Employed bifurcation analysis to identify Flip and Hopf bifurcations affecting the machining behavior.
- Machine Learning & AI Integration:
 - Developed a multi-sensor fusion-based deep learning framework integrating vibration and audio signals for real-time chatter detection, achieving 95.31% accuracy.
 - Implemented a stacking-based ensemble machine learning model (SVR, DTR, RFR, ANN) for surface form error prediction, achieving less than 10% prediction error.
- Industrial Application: Developed a web-based interface for real-time process monitoring, enabling AI-driven manufacturing optimization, chatter mitigation, and precision machining enhancements.

Developed GUI:

Sibilytics-AI is a free, browser-based platform developed to facilitate wavelet-based feature extraction from sensor signals. Designed with researchers, engineers, and data scientists in mind, it offers a comprehensive suite of tools for signal decomposition, visualization, and high-resolution export.

Key Features:

- Extensive Wavelet Selection: Choose from a diverse range of wavelet families—including Daubechies, Morlet, Symlets, and Coiflets—to tailor your analysis to specific signal characteristics.
- Interactive Visualizations: Generate and customize plots such as scalograms and time-frequency representations, enabling in-depth exploration of signal features.
- High-Resolution Export: Save your visualizations in high-resolution formats suitable for publications, presentations, or further analysis.
- User-Friendly Interface: Built on the Streamlit framework, the platform ensures an intuitive and responsive user experience without the need for complex installations.

Applications:

Ideal for a variety of domains, including biomedical signal processing (e.g., EEG, EMG), structural health monitoring, vibration analysis, and other fields where time-frequency analysis is crucial.

Get Started: Access the platform directly at sibilytics-ai.in and begin your signal analysis journey today.

Projects Handled:

- Additive manufacturing of steel structures for automotive applications – Nov 2025 to Till Date
- Manufacturing of Thin-walled Ti structures for Bio-medical applications – Nov 2020 to Dec 2024.
- Dynamic stability modelling of high speed micromilling of Ti6Al4V alloys – Jan 2021 – Dec 2024.
- Cutting tool dynamics of tungsten carbide end mills for machining titanium and nickel alloys – April 2021 – Dec 2024.
- Development of cloud-based platform for real-time stability prediction with minimum human interaction – April 2022 – April 2023.
- Study on the Effect of Turbulence Models on the Solutions of Orifice Flow - UG Project.
- Design and Development of Abrasive Flow Finishing Setup for Machining Internal Features – PG Project.
- Identification of damage in additive manufactured components using image processing technique (CNN and Statistical Analysis) – Oct 2021 to Mar 2022
- Prediction of stable process parameters for milling of hard to machine alloys like Ni and Ti based alloys using machine learning (PCA, SVM, DTW, VMD) – Jan 2021 to Aug 2021
- Implemented transfer learning approach using multi-sensor data to identify chatter in real-time milling of IN-718 with 96% accuracy in prediction (Data Mining) – April 2023 to Oct 2023
- Audio signal-based support vector classifier have been developed with 92% accuracy for instability identification in high-speed machining of Ti6Al4V – Dec 2023 to June 2024

Academic Achievements:

1. Recipient of country's prestigious fully funded **National Postdoctoral Fellowship** (ANRF-NPDF) for 2 years.
2. "**Outstanding PhD Thesis Award**" at the convocation 2025 held on August 3rd at **BITS-Pilani, Hyderabad campus**.
3. "**Excellence in Research**" award at the industry day & doctoral research symposium held on 20th April 2024 at **BITS-Pilani, Hyderabad campus**.
4. Won **200\$** amount as a **student award in WCMNM-2021**, held at **IIT-Bombay**.
5. Received a **Project Grant worth 6000/- Rs from Karnataka State Council for Science & Technology** in 2016.
6. Won **best paper award** in the National Conference held at AIT, Chikkamagalur in 2016.
7. I graduated bachelor's degree with an **IV Rank** from **PES College of Engineering, Mandya**.

Referees:

1. Dr. Kundan K Singh, Assistant Professor at BITS-Pilani, ksingh@hyderabad.bits-pilani.ac.in, (+91)-989281388
2. Prof. Ramesh K Singh, Professor at IIT- Bombay, rsingh@iitb.ac.in, (+91)- 9930950219
3. Dr. Rinku K Mittal, Assistant Professor at IIT- Guwahati, rkmittal@iitg.ac.in, (+91)-361-258-3576

4. Prof. B Sadashivegowda, Principal, Vidyavardhaka College of Engineering, Mysuru, principal@vvce.ac.in, (+91)-99456-50016; (+91)-821-4276-225

Detailed List of Publications: (updated as on 15.01.2026)

H-index: 05, Citations: 76, Scopus author Id: 57218256360 and Orcid Id: 0000-0002-2535-7247

Published Journal Articles

1. Gururaja, Sethurao, and Kundan K. Singh. "Explainable Framework Based on Integrated Sensor Fusion and Deep Learning to Estimate Stability in High-speed Micromilling of Thin-walled TC4 Alloy." Engineering Applications of Artificial Intelligence 161 Part-C (2025): 112326, pp. 1-24 **[Q1, SCI, 1st Author, IF: 8.0]**
2. Gururaja, Sethurao, and Kundan K. Singh. "Machine learning Based Assessment of Audio Signal Features for Chatter Identification in High-Speed Micromilling of Thin-Walled TC4 Alloy." Precision Engineering 94 (2025): 820-840. **[Q1, SCIE, 1st Author, IF: 3.7]**
3. Gururaja, Sethurao, and Kundan K. Singh. "Bifurcation analysis for instability detection in high-speed micromilling of thin-walled Ti6Al4V structure." CIRP Journal of Manufacturing Science and Technology 49 (2024): 150-166. **[Q1, SCIE, 1st Author, IF: 5.4]**
4. Gururaja, Sethurao, Sachin Alya, and Kundan K. Singh. "Study on improving surface integrity for additively manufactured Inconel 718 via high-speed micromilling." Materials and Manufacturing Processes 40(3) (2024): 335-352. **[Q1, SCIE, 1st Author, IF: 4.7]**
5. Gururaja, Sethurao, Akula Rahul, Srinivasa Rao Nandam, and Kundan Kumar Singh. "Parametric evaluation of chip formation in peripheral milling of single crystal Ni-based superalloy." The International Journal of Advanced Manufacturing Technology 132, no. 5 (2024): 2293-2313. **[Q1, SCIE, 1st Author, IF: 3.5]**
6. Gururaja, Sethurao, and Kundan K. Singh. "Development of smart manufacturing framework for micromilling of thin-walled Ti6Al4V." Machining Science and Technology 28(3) (2024): 459-488. **[Q2, SCIE, 1st Author, IF: 3.2]**
7. Gururaja, Sethurao, and Kundan K. Singh. "Temporal feature analysis of audio signal for instability identification in high-speed micro milling of thin-walled Ti6Al4V." Journal of Micromanufacturing (2024): 25165984241293915. **[Q2, Scopus, 1st Author]**
8. Gururaja, Sethurao, and Kundan K. Singh. "Influence of microphone tilt angle on instability identification in micromilling of thin-walled Ti6Al4V." Manufacturing Letters 35 (2023): 333-341. **[Q2, Scopus, 1st Author, IF: 2.0]**
9. Gururaja, Sethurao, Umar Ahmad, and Kundan K. Singh. "Development of automated impact system for modal analysis of micro-end mill." Manufacturing Letters 35 (2023): 117-126. **[Q2, Scopus, 1st Author, IF: 2.0]**
10. Gururaja, Sethurao, Panigrahi, Brajesh, and Kundan K. Singh. "The Effect of Speed-Varying Micro-Cutting Tool Dynamics on Stability During High-Speed Micromilling of Ti6Al4V." ASME Journal of Micro-and Nano-Manufacturing 10, no. 2 (2022): 021003. **[Q3, Scopus, 1st Author, IF: 1.0]**
11. Taylur, Sameer, S. Gururaja, Kundan K. Singh, and Brajesh Kumar Panigrahi. "Machined Surface Image Analysis for Process Instability Identification in Micromilling of Ti6Al4V." Manufacturing Letters 33 (2022): 174-182. **[Q2, Scopus, 2nd Author, IF: 2.0]**
12. Gururaja, Sethurao, and Kundan K. Singh. "Hybrid Meta-Models for Surface Form Error Prediction in High-speed Micromilling of Thin-Walled TC4 Alloys: A Stacking-based Ensemble Approach." ASME Journal of Micromanufacturing (Accepted for Publication) **[Q3, Scopus, 1st Author, IF: 1]**

Book Chapter

1. Gururaja, Sethurao, Kundan K. Singh, and R. K. Mittal. "Analysis of Numerical Method for Modal Analysis of Thin-Walled Structures for Achieving Low-Cost Manufacturing." In North-East Research Conclave, pp. 1-20. Singapore: Springer Nature Singapore, 2022. **[Q4, Scopus, 1st Author]**

List of National/International Conferences

1. Gururaja, Sethurao, and Kundan K. Singh. "Temporal feature analysis of audio signal for instability identification in high-speed micro milling of thin-walled Ti6Al4V." 9th International and 30th All India Manufacturing Technology, Design and Research Conference (AIMTDR), 8-10 December 2023, IIT BHU, Varanasi, India.
2. Gururaja, Sethurao, and Kundan K. Singh. "Influence of Microphone Tilt Angle on Instability Identification in Micromilling of Thin-walled Ti6Al4V", to 51st SME North American Manufacturing Research Conference (NAMRC 51), 12-16 June 2023, Rutgers University, New Brunswick, New Jersey, USA.
3. Gururaja, Sethurao, Umar Ahmad, and Kundan K. Singh. "Development of automated impact system for modal analysis of micro-end mill", to 51st SME North American Manufacturing Research Conference (NAMRC 51), 12-16 June 2023, Rutgers University, New Brunswick, New Jersey, USA.
4. Sameer, Taylur, Gururaja, Sethurao, and Kundan K. Singh. "Machined Surface Image Analysis for Process Instability Identification in Micromilling of Ti6Al4V", to 50th SME North American Manufacturing Research Conference (NAMRC 50), 27 June – 1st July 2022, Purdue University, West Lafayette, Indiana, USA.
5. Gururaja, Sethurao, Kundan K. Singh, and R. K. Mittal. "Analysis of Numerical Method for Modal Analysis of Thin-Walled Structures for Achieving Low-Cost Manufacturing." In North-East Research Conclave, 20-22 May 2022, IIT-Guwahati, Assam, India.
6. Gururaja, Sethurao, and Kundan K. Singh. "Cutting Velocity and Chip Load Dependent Force Prediction in High Speed Micromilling of Ti6Al4V Using Deep Learning Method." In World Congress on Micro and Nano Manufacturing (WCMNM), 20-23 September 2021, IIT Bombay, Mumbai, India.