Sreedhar Unnikrishnakurup

Scientist, Institute of Material Research and Engineering

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https://scholar.google.com/citations?user=rgeu6SAAAAAJ&hl=en

HIGHLIGHTS

- Postdoc experience in Online weld quality monitoring using Infrared Thermography (IRT), Pulsed IRT and THz-Time Domain spectroscopy (THz-TDS) for coating thickness inspection, composite inspection using pulsed IRT, lock-in IRT and Induction heating IRT, Laser IRT for crack inspection, Numerical study of heat transfer in Polycrystalline Microstructure, and X-ray radiography and Computed Tomography (CT) for weld inspection.
- Ph.D. from University of Montpellier 2, France in Welding Engineering and Inverse analysis for multi-parameter optimization.
- MS from Indian Institute of Technology (IIT) Madras in online monitoring of Weld quality using IRT and X-ray.
- Expert practical experience in MATLAB and Python. Experience in industrial project management. Published 11 international Journals and several conference proceedings.

WORK EXPERIENCE

Scientist

Institute of Material Research and Engineering (IMRE), A*STAR

Nov 2021–Ongoing — Singapore

- Advanced Nondestructive Infrared Thermography applications
- Composite inspection using induction heating IRT.
- IRT inspection of building materials

Postdoctoral Scientist

Centre for Non-Destructive Evaluation (CNDE), IIT Madras

May 2018 - Sep 2021 — Chennai, India

- Application of Nondestructive IRT testing for thickness inspection of thermal barrier coatings and validation using THz-TDS and Eddy current testing.
- Composite inspection using induction heating IRT.
- Crack inspection in steel billets at elevated temperatures using Laser assisted IRT.
- Development of artificial intelligence assisted advanced radiography imaging and automatic defect recognition of critical welds and high energy materials
- Ray tracing algorithms for X-ray radiography simulations and CT reconstruction algorithms
- Numerical investigation of anisotropic heat diffusion in polycrystalline and composite microstructures.

Cohort Member BA3

Entrepreneur First

February 2020 - May 2020 — Bangalore, India

- Explored several interesting technological solutions, exploring the market, validating the technology, speaking to customers, and researching prototypes

- The ideas that we worked on are detect and report quality-compromised and counterfeit drugs using a mobile cloud-based cost-effective hyper-spectral Imaging based AI device

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Postdoctoral Research Scientist

NDT group 8.7, Federal Institute for Material Research and Testing (BAM)

January 2016 - June 2017 — Berlin, Germany

- Development of computational simulations to study the active thermographic testing for defect detection in composites
- Pulsed, Lock-in, and Step heating IRT testing of fiber reinforced composites
- Optimize and validate active thermography as full-field, fast and non-contact NDE technique for quantitative testing of FRP structures

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Visiting Research Scientist

Electromagnetic NDT Research Group, West Pomeranian University (ZUT)

January 2015 - June 2015 — Szczecin, Poland

- Terahertz imaging and time domain analysis for material defect identification in Composite Wind turbine blades
- Active Infrared Thermography for defect identification in composite materials - Numerical investigations of heat sink effects in the infrared inspecton of composites

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Institute Postdoctoral Fellow

Centre for Non-Destructive Evaluation (CNDE), IIT Madras

September 2014 - December 2015 — Chennai, India

- Numerical modelling of microstructural heat diffusion and ultrasonic wave propagation in Polycrystalline Materials
- CMT welding process monitoring using IR thermography
- In-line laser thermography for Online Monitoring of steel billets to predict the surface cracks formed during the non-uniform cooling

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Research Associate

Centre for Non-Destructive Evaluation (CNDE), IIT Madras

April 2007 - December 2008 — Chennai, India

- Development of online weld quality monitoring for AA2219 liquid propellant tanks using Infrared Thermal Imaging and X-ray radiography
- Developed a finite element model for the prediction of temperature profiles during welding

EDUCATION

Ph.D. in Mechanical Engineering

University of Montpellier 2 (UM2)

2011 - 2014 — Montpellier, France

- Dissertation Topic: Weld pool shape identification using Multi-physics modelling and Experiments

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M.S. in Mechanical Engineering

Indian Institute of Technology Madras

2008 - 2010 Chennai, India

- Dissertation Topic: Online weld quality monitoring using Infrared Thermal Imaging
- Cumulative Grade Point Average 8 out of 10

Bachelors in Mechanical Engineering

Institution of Engineers India

2002 - 2006 Kottayam, India

- Cumulative Grade Point Average 6.94 out of 10

PUBLICATION

Dissertations

1. **Sreedhar U**. *Static GTAW: experimental and numerical investigations and heat flux parameter estimation*. PhD thesis, Universite Montpellier-II, Montpellier, France, 2014. URL `https://bit.ly/2UFQyFi` [1]
2. **Sreedhar U**. Online weld quality monitoring using infrared thermal imaging. Master's thesis, Indian Institute of Technology Madras, Chennai, India, 2011 [2]

Journal Articles

1. Mercy L, **Sreedhar U**, J Abhinandan, M K Patra, and K Balasubramaniam. Material characterization and thickness measurement of iron particle reinforced polyurethane multi-layer coating for aircraft stealth applications using thz-time domain spectroscopy. *Journal of Infrared, Millimeter, and Terahertz Waves*, 2022. URL `https://bit.ly/3vQhipj` [3]
2. Renil K T, **Sreedhar U**, K Balasubramaniam, and CV Krishnamurthy. The influence of interlaminar microstructure on the induction heating patterns of cfrp laminates. *Composites Part B: Engineering*, 2022 [4]
3. D Gamdha, **Sreedhar U**, and K Balasubramaniam. Automated defect recognition on x-ray radiographs of solid propellant using deep learning based on convolutional neural networks. *Journal of Nondestructive Evaluation*, 40 (18), 2021. URL `https://bit.ly/3aLxA7k` [5]
4. Surendra G, Ameen E, **Sreedhar U**, K Balasubramaniam, A Veeraragavan, and B Pesala. Spectral filtering of sub-bandgap radiation using all-dielectric gratings for thermophotovoltaic applications. *Journal of Photonics for Energy*, 11(1):015501, 2021. URL `https://bit.ly/3paK9hv` [6]
5. **Sreedhar U**, J Dash, S Ray, B Pesala, and K Balasubramaniam. Nondestructive evaluation of thermal barrier coating thickness degradation using pulsed IR thermography and THz TDS measurements: A comparative study. *NDT & E*, 116:102367, 2020. URL `https://bit.ly/2GJUUHw` [7]
6. A Saini, **Sreedhar U**, C V Krishnamurthy, T Sundararajan, and K Balasubramaniam. Numerical study using finite element method for heat conduction on heterogeneous material with varying volume fraction, shape and size of filler in matrix. *International Journal of Thermal Sciences*, 159:106545, 2020. URL `https://bit.ly/31qVIYg` [8]
7. P V Nithin, R T Kidangan, **Sreedhar U**, P Myrach, M Ziegler, and K Balasubramaniam. Laser line scanning thermography for surface breaking crack detection: modeling and experimental study. *Infrared Physics & Technology*, 104:103141, 2020. URL `https://bit.ly/2YvQJ7h` [9]
8. P V Nithin, R T Kidangan, **Sreedhar U**, P Rajagopal, K V Phani Prabhakar, G Padmanabham, and K Balasubramaniam. Numerical model and experimental validation for the on-line monitoring of cold metal transfer joining of aluminium to galvanized steel. *International Journal of Advanced Manufacturing Technology*, 104:4365–4375, 2019. URL `https://bit.ly/2AnbYQF` [10]
9. C Maierhofer, R Krankenhagen, M Roellig, **Sreedhar U**, C Monte, A Adibekyan, B Gutschwager, L Knazowicka, A Blahut, and M Gower. Influence of thermal and optical material properties on the characterization of defects in fiber reinforced composites with active thermography methods. *tm-Technisches Messen*, 85(1):13–27, 2018. URL `https://bit.ly/3hswSOI` [11]

10. **Sreedhar U**, S Rouquette, F Soulié, and G Fras. Estimation of heat flux parameters during static gas tungsten arc welding spot under argon shielding. *International Journal of Thermal Sciences*, 114:205–212, 2017. URL `https://bit.ly/3d10rnl` [12]
11. R T Kidangan, **Sreedhar U**, PV Nithin, K Balasubramaniam, P Rajagopal, KV Phani Prabhakar, G Padmanabham, F Riedel, and M Puschmann. Online monitoring of cold metal transfer (CMT) process using infrared thermography. *Quantitative InfraRed Thermography Journal*, 14(1):68–78, 2017. URL `https://bit.ly/2zyzWrI` [13]
12. **Sreedhar U**, CV Krishnamurthy, and K Balasubramaniam. Monitoring tig welding using infrared thermography–simulations and experiments. *Przegląd Elektrotechniczny*, 92(4):6–9, 2016. URL `https://bit.ly/2UGtp5I` [14]
13. **Sreedhar U**, CV Krishnamurthy, K Balasubramaniam, VD Raghupathy, and S Ravisankar. Automatic defect identification using thermal image analysis for online weld quality monitoring. *Journal of Materials Processing Technology*, 212(7):1557–1566, 2012. URL `https://bit.ly/3d5JMiA` [15]

Forthcoming [Under Review]

1. Renil K T, **Sreedhar U**, K Balasubramaniam, and CV Krishnamurthy. Induction-induced local heating patterns to identify layer orientation of multi-layer cfrp using 2dfft analysis of thermal images. *Composites Part B: Engineering*, 2023 [16]

Conference Presentations

1. Vinod Kumara, Carlos Manzano, **Sreedhar U**, Jonathan Zheng, and Andrew Ngob. Dynamic inspection of surface-breaking defects using induction thermography. In *Singapore International Non-destructive Testing Conference and Exhibition (SINCE2022)*, Singapore, November 2022[17]
2. Jonathan Zheng, Carlos Manzano, **Sreedhar U**, Vinod Kumar, and Andrew Ngo. Using hyperspectral imaging as a non-destructive method to discern artworks. In *Singapore International Non-destructive Testing Conference and Exhibition (SINCE2022)*, Singapore, November 2022[18]
3. **Sreedhar U**, Jonathan Zheng, Vinod Kumar, Carlos Manzano, and Andrew Ngo. Crack detection in metallic components with varying surface characteristics using laser spot scanning thermography. In *Singapore International Non-destructive Testing Conference and Exhibition (SINCE2022)*, Singapore, November 2022 [19]
4. **Sreedhar U**, Zheng J, Manzano C, and Ngo C, Y. Numerical and experimental investigations of pulsed infrared thermography for damage detection in honeycomb sandwich composites. In *16th Quantitative Infrared Thermography Conference*, Paris, France, July 2022 [20]
5. J Dash, **Sreedhar U**, B Pesala, and K Balasubramaniam. Material parameters and thickness determination of thermal barrier coatings using terahertz time domain spectroscopy. In *Virtual Conference and Exhibition on Non-destructive Evaluation (NDE)*, Virtual, December 2020 [21]
6. Surendra G, Ameen E, A Veeraraghavan, **Sreedhar U**, K Balasubramaniam, and B Pesala. High contrast grating based broadband thermal filters for thermophotovoltaic applications. In *SPIE. Photonic West OPTO*, San Francisco, US, February 2020 [22]
7. D Gamdha, S Dwarakanath, **Sreedhar U**, and K Balasubramaniam. Simulation assisted annotated xray image data generation for deep learning applications. In *National Seminar and Exhibition on Non-Destructive Evaluation NDE*, Bangalore, India, December 2019 [23]
8. **Sreedhar U**, J Dash, B Pesala, and K Balasubramaniam. Non-destructive evaluation of thermal barrier coating thickness degradation using pulse phase thermography and THz-TDS. In *11th International Symposium on NDT in Aerospace*, Paris-Saclay, France, November 2019. URL `https://bit.ly/2ZDVsEn` [24]
9. S Krishna, **Sreedhar U**, and K Balasubramaniam. Evaluation of thermal barrier coating thickness using pulsed thermography experiments and numerical simulations. In *National Seminar and Exhibition on Non-Destructive Evaluation NDE*, Mumbai, India, December 2018 [25]
10. P V Nithin, R T Kidangan, **Sreedhar U**, Krishnamurthy C, V, M Zeigler, P Myrach, and K Balasubramaniam. Numerical study of laser line thermography for crack detection at elevated temperature. In *14th Quantitative Infrared Thermography Conference*, Berlin, Germany, June 2018. URL `https://bit.ly/2VLk0u8` [26]
11. C Maierhofer, R Krankenhagen, M Röllig, **Sreedhar U**, C Monte, A Adibekyan, B Gutschwager, L Kanzowicka, A Blahut, Gower M R L, M Lodeiro, Baker G, and Aktas A. Einfluss thermischer und optischer materialeigenschaften auf die charakterisierung von fehlstellen in faserverbund-werkstoffenmit aktiven thermografieverfahren. In *Temperature*, Berlin, Germany, May 2017. URL `https://bit.ly/2C7nJuS` [27]
12. S Krishna, P V Nithin, R T Kidangan, **Sreedhar U**, M Zeigler, P Myrach, K Balasubramaniam, and Biju P. Raw data-based image processing algorithm for fast detection of surface breaking cracks. In *43rd Annual Review of Progress in Quantitative Nondestructive Evaluation, AIP Conference Proceedings*, Atlanta, Georgia, US, July 2017. URL `https://bit.ly/3e2aEQW` [28]

13. R T Kidangan, **Sreedhar U**, K Balasubramaniam, L Narayanan, and G Phanikumar. Dissimilar metal joint quality measurement using infrared thermography: Experimental and numerical approach for the application to cmt welding. In *Quantitative InfraRed Thermography*, Gdańsk, Poland, July 2016. URL `https://bit.ly/3e1f8Y7` [29]
14. P V Nithin, S Krishna, R T Kidangan, **Sreedhar U**, C V Krishnamurthy, M Zeigler, P Myrach, and K Balasubramaniam. In-line laser thermography for crack detection at elevated temperature: A numerical modeling study. In *Quantitative InfraRed Thermography*, Gdańsk, Poland, July 2016. URL `https://bit.ly/2ZOCBV2` [30]
15. B Polomski, P Myrach, E Le Claire, **Sreedhar U**, P V Nithin, K Balasubramaniam, and M Ziegler. Thermographic crack detection in hot steel surface. In *19th World Conference on Non-destructive Testing (WCNDT)*, Munich, Germany, June 2016. URL `https://bit.ly/3grMvER` [31]
16. R T Kidangan, **Sreedhar U**, P V Nithin, K Balasubramaniam, P Rajagopal, V Phani Prabhakar, K, and G Padmanabham. Application of infrared thermography technique for the monitoring of cold metal transfer (cmt) joining of aluminium to galvanized steel. In *19th World Conference on Non-destructive Testing (WCNDT)*, Munich, Germany, June 2016. URL `https://bit.ly/2NYJqQp` [32]
17. Shivaprasad S, **Sreedhar U**, S Natarajan, C V Krishnamurthy, and K Balasubramaniam. 3d elastic wave propagation and heat diffusion studies using polycrystalline material models. In *National Seminar and Exhibition on Non-Destructive Evaluation NDE*, Hyderabad, India, November 2015. URL `https://bit.ly/2NYasaM` [33]
18. **Sreedhar U**, P V Nithin, C V Krishnamurthy, M Zeigler, P Myrach, and K Balasubramaniam. The effect of surface breaking crack orientation in detection capability: A laser thermography numerical modeling approach. In *National Seminar and Exhibition on Non-Destructive Evaluation NDE*, Hyderabad, India, November 2015 [34]
19. Shivaprasad S, **Sreedhar U**, C V Krishnamurthy, and K Balasubramaniam. Elastic wave propagation and heat diffusion studies in polycrystalline material. In *Comsol Conference*, Pune, India, October 2015. URL `https://bit.ly/2BE2YqQ` [35]
20. **Sreedhar U**, C V Krishnamurthy, and K Balasubramaniam. Heat diffusion in polycrystalline materials- a microstructure-based material model. In *Quantitative InfraRed Thermography Conference QIRT-Asia*, Mahabalipuram, India, July 2015. URL `https://bit.ly/2BEf0R1` [36]
21. B Szymznik, **Sreedhar U**, T Chady, and K Balasubramaniam. Numerical analysis of heat sink effect in the infrared inspection of composites. In *Quantitative InfraRed Thermography Conference QIRT-Asia*, Mahabalipuram, India, July 2015. URL `https://bit.ly/3dZVz2m` [37]
22. **Sreedhar U**, P V Nithinn, C V Krishnamurthy, M Zeigler, P Myrach, and K Balasubramaniam. In-line laser thermography for crack detection: A numerical approach. In *Quantitative InfraRed Thermography Conference QIRT-Asia*, Mahabalipuram, India, July 2015. URL `https://bit.ly/3iwPe1F` [38]
23. **Sreedhar U**, K Balasubramaniam, S Gollapudi, and S Kuchibhatla. Non-destructive evaluation of seams and composites at iit madras. In *Research seminar SAINT-GOBAIN University Day*, Paris, France, June 2015 [39]
24. **Sreedhar U**, C V Krishnamurthy, and K Balasubramaniam. Monitoring tig welding using infrared thermography-simulations and experiments. In *XVIII International Symposium on Theoretical Electrical Engineering ISTET'15 & Symposium on Electromagnetic Evaluation of Materials SEEM'15*, Kolobrzeg, Poland, June 2015. URL `https://bit.ly/38v5USQ` [40]
25. T Chady, Li Yijin, and **Sreedhar U**. Evaluation of thz systems for composite structures inspection. In *XVIII International Symposium on Theoretical Electrical Engineering ISTET'15 & Symposium on Electromagnetic Evaluation of Materials SEEM'15*, Kolobrzeg, Poland, June 2015. URL `https://bit.ly/3f0p9WN` [41]
26. B Szymanik, **Sreedhar U**, and K Balasubramaniam. Background removal in thermographic non-destructive testing of composite materials. In *National Seminar and Exhibition on Non-Destructive Evaluation NDE*, Pune, India, December 2014. URL `https://bit.ly/2NWtA95` [42]
27. S Rouquette, F Soulie, and **Sreedhar U**. Gaussian heat flux parameter estimation during a gtaw operation. international conference on inverse problems in engineering. In *International conference on inverse problems in engineering*, Krakow, Poland, May 2014. URL `https://bit.ly/3f32hFR` [43]
28. **Sreedhar U**, S Rouquette, F Soulie, and G Fras. Estimation of the heat flux exchanged between argon electrical arc plasma and stainless steel anode: application to gtaw experiment. In *4th International Symposium on Inverse Problems, Design and Optimization (IPDO)*, Albi, France, June 2013. URL `https://bit.ly/3dW2461` [44]
29. **Sreedhar U**, S Rouquette, F Soulie, and G Fras. Multi-physics modeling of gtaw process and experimental validation for investigating the weld pool formation. In *International seminar Numerical Analysis of weldability*, Graz, Austria, September 2012. URL `https://bit.ly/2YXEbaa` [45]
30. **Sreedhar U**, S Rouquette, F Soulie, and G Fras. Multi-physics modeling of gtaw process. In *La Journée conference des doctorants de l'I2S (DOCTISS), The Graduate School for Information, Structures and Systems Sciences (I2S)*, Montpellier, France, June 2012 [46]
31. S Rouquette, **Sreedhar U**, F Soulie, and G Fras. Heat flux parameter estimation by the levenberg-marquardt method: Application to the gas tungsten arc welding. In *International seminar in Inverse Problems. University of Cambridge*, London, UK, December 2011. URL `https://bit.ly/2NTJbq1` [47]

32. **Sreedhar U**, C V Krishnamurthy, K Balasubramaniam, Reghupathi V, and Ravisankar S. Modeling and simulation for temperature prediction in welding using infrared thermography. In *National Seminar NDE*, Trichy, India, December 2009. URL `https://bit.ly/31KyuOw` [48]

INVITED PRESENTATIONS

- Preconference Tutorials, NDE 2019 Organized by Indian Society for Non-Destructive Evaluation ISNT, Talk: Applications of thermal imaging in aerospace industry, Bengaluru, December 3, 2019
- Workshop on Advanced NDE Techniques and Applications organized by TATA STEEL, Talk: Advanced Thermography Techniques, TATA Nagar, Jamshedpur, India, August 17, 2015
- Polish society for theoretical and applied electrical engineering section in Szczecin (PTETiS), Talk: Research and Development in the field of NDE @ CNDE, West Pomeranian University of Technology, Szczecin, Poland, March 12, 2015
- Polish society for nondestructive testing and technical diagnostic section in Szczecin (PTBNiDT), Talk: Research and Applications of IR Thermography @ CNDE, Szczecin, Poland, February 26, 2015

RESEARCH INTEREST

With in the field of mechanical engineering and material Science, my research interests span the areas of Nondestructive Testing and Evaluation particularly in Infrared Thermal Imaging and X-ray radiography, Welding process, Online monitoring, Hyperspectral Imaging, Ray Tracing, Computational modeling, Microstructural based material modeling, Data driven scientific computing, Deep learning and Machine Learning.

SKILLS

●●●●● MATLAB	●●●●● COMSOL	●●●●● Deep learning
●●●●○ Python	●●●●○ ANSYS	●●●●○ Computer vision
●●●●○ Numpy	●●●●○ LaTeX	●●●●○ Pytorch
●●●○○ Pandas	●●●○○ Git	●●●○○ Tensorflow

GRANTS AND FELLOWSHIPS

- Travel Grant to attend international scientific event from Council of Scientific & industrial Research — 2019
- Visiting Researcher Fellowship under EU Project Health Monitoring of Offshore Wind Farms (HEMOW) — 2015
- Institute Postdoctoral Research Grant from Indian Institute of Technology Madras — 2014-2015
- French research allowance from University of Montpellier for carrying out Ph.D. — 2011-2013
- Post-Graduate Fellowship: GATE from Govt. of India — 2008-2010

LANGUAGES

English	●●●●●	Malayalam	●●●●●
German	●●●○○	Hindi	●●●○○
French	●●○○○	Tamil	●●○○○

MENTORING

5 Ph.D. Students and 4 Master student

- Shivaprasad S (Ph.D.) - Voronoi Cell based FEM simulations for wave propagation in solids [33, 35]
- Renil Thomas K (Ph.D.) - Induction thermography inspection of CFRP and CMT weld monitoring [4, 13, 29, 32]
- Nithin P V (Ph.D.) - Laser thermography for carack inspection in steel samples at elevated temperature [9, 10, 26, 30]
- Shruthi Krishna (Ph.D.) - Pulsed thermographic inspection of thermal barrier coatings [25, 28]
- Surendra Gupta (Ph.D.) - Emissivity characterization of nano photonic emitters [6, 22]

- Anurag Saini (MTech) - Numerical investigation of Heat diffusion in particle reinforced composite [8]
- Dhruv Gamdha (MTech) - Ray tracing model for X-ray simulation and AI based automatic defect Recognition [5, 23]

REFERENCES

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