

Dr. S. Narayanan

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## CONTACT INFORMATION:

Associate Professor  
Department of Mechanical Engineering  
Indian Institute of Technology (ISM) Dhanbad  
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## EDUCATION:

Indian Institute of Technology Madras	Mechanical Engineering	PhD	2011 (MS upgraded to PhD)
University of Calicut	Mechanical Engineering	B-Tech	2002

## RESEARCH INTERESTS:

Experimental Fluid Mechanics, Experimental Aeroacoustics, High Speed and Low Speed Jet Flows, Airfoil noise and control, Aerodynamics, Atomization of Droplets And Sprays using acoustic streaming, Thermo-acoustic instability and control, Acoustofluidics

## TEACHING:

Incompressible and Compressible Flow, Fundamentals of Aeroacoustics (New course developed at IIT (ISM) Dhanbad), Fluid Mechanics, Gas Dynamics, Fundamentals of Aerodynamics

## POSITIONS HELD:

IIT (ISM) Dhanbad	Associate Professor	April 2021-present
IIT (ISM) Dhanbad	Assistant Professor	2015-2021
Institute of Sound and Vibration Research (ISVR), Acoustics Research Group, Rolls Royce University Technology Centre of Gas Turbine Noise, University of Southampton, UK	Postdoctoral Research Fellow	2013(Jan)-2014(Dec)
College of Engineering Trivandrum, Kerala	Assistant Professor	2010-2012

## OTHERS:

**Life Member:** Indian Society for Heat and Mass Transfer (ISHMT)

**Associate Editor:** Noise and Vibration Worldwide Journal, Sage publication

**Associate Editor:** ASME Journal of Engineering and Science in Medical Diagnostics and Therapy

**Link:** <https://journaltool.asme.org/home/Mastheads.cfm?JournalID=32>

**Guest edited** two issues for International Journal of aeroacoustics, Sage publication

(i) First issue Published in July 2020, <https://doi.org/10.1177/1475472X20933028>  
Volume: 19 issue: 3-5.

(ii) Second issue Published in March 2021, <https://doi.org/10.1177/1475472X21997015>, 2021,  
Vol. 20(1-2) 3. file:///E:/IAERO%20Editor/Issue\_2/JAE20\_1\_2.pdf

**Guest edited** two issues for Noise and Vibration Worldwide Journal, Sage publication

**Recipient of Rolls Royce Inventor Award for the granted patent:** Multi-Frequency Leading Edge Serration for Reduced Aerofoil Noise, EP 3121 376 A1, dated 25/01/2017, bulletin 2017/04, US 2017/0022820 A1

**Session Chair for the** 48TH NATIONAL CONFERENCE ON FLUID MECHANICS AND FLUID POWER (FMFP 2021), 27TH DEC – 29TH DEC, 2021, BITS PILANI, PILANI CAMPUS, RJ, INDIA TENTATIVE SCHEDULE

**Director's appreciation for the very good teaching feedback for the course "Incompressible and Compressible Flow" (MEC507) in 2022-2023 Monsoon semester**

## REVIEWER OF MANY PEER REVIEWED INTERNATIONAL JOURNALS (SOME ARE LISTED BELOW)

- (i) Journal of Sound and Vibration (JSV)
- (ii) Physics of Fluids
- (iii) American Institute of Aeronautics and Astronautics (AIAA) journal
- (iv) International Journal of Aeroacoustics
- (v) Applied Acoustics
- (vi) Proceedings of the Institute of Mechanical Engineers, Journal of Aerospace Engineering: Part G
- (vii) Noise control Engineering Journal
- (viii) Noise and Vibration Worldwide

## REVIEWER OF DST (SERB) PROJECT PROPOSALS

## EXTERNAL EXAMINER

**PG, Dual Degree:** IIT Kharagpur

**PhD Thesis Examiner:** Indian and Foreign universities (Evaluated Two Thesis from CUSAT, INDIA and one thesis from University of Auckland)

## **INTERNATIONAL / NATIONAL COLLABORATIONS**

Prof. Phillip Joseph, Prof. Chaitanya Paruchuri, ISVR, University of Southampton, UK

Dr. Lorna Ayton, University of Cambridge, UK

Dr. Michael Kingan University of Auckland, Newzealand

Prof. K. Srinivasan, IIT Madras, India

Prof. Gopalan Jagadeesh, IISC Bangalore, India

Prof. Deepak Mandal, IIT(ISM) Dhanbad, India

Prof. R.N Hota, IIT(ISM) Dhanbad, India

## **LAB / COURSE DEVELOPED AT IIT(ISM) DHANBAD**

**New Lab developed at IIT(ISM) Dhanbad:** Aeroacoustics Lab

**New Course developed at IIT(ISM) Dhanbad:** Fundamentals of Aeroacoustics

**Start up:** Technical Advisor for the startup AASMAA Aerospace pvt Ltd

## **PUBLICATIONS**

### **JOURNALS**

1. Aadil Kureshee, N. K. Jha, Vikram Singh, R. N. Hota, **S. Narayanan** and Deepak Kumar Mandal, Effect of single and multiple acoustic frequencies on the atomization of a spray, *Physics of Fluids*, 36, 000000 (2024); [doi: 10.1063/5.0243668](https://doi.org/10.1063/5.0243668) (Accepted)
2. Aadil Kureshee, **S. Narayanan** and Deepak Kumar Mandal, Acoustic induced flow on the evaporation dynamics of twin drops, *International Journal of Multiphase Flow* (Accepted) [doi:10.1016/j.ijmultiphaseflow.2024.105070](https://doi.org/10.1016/j.ijmultiphaseflow.2024.105070)
3. **S. Narayanan**, Sushil Kumar Singh, Manish Kant, Aadit Narayanmurthy, Control of fan broadband noise through wavy leading and trailing edge serrations, *International Journal of Aeroacoustics* (Accepted)
4. S. Singh, Kumar, Bhaumik, P.K. Singh, and **S. Narayanan**, Thickness Profile Measurements of Acoustic Induced Maneuvering of Thin Film Evaporation, *Heat Transfer Engineering*, (Accepted)
5. Sujit Kumar, Sushil kumar Singh, Shailesh Jha, Kabilan Baskaran, K. Srinivasan and **S. Narayanan**, On the reductions of airfoil broadband noise through circular dimples, *Applied Acoustics*, (2024), 217, 109819, <https://doi.org/10.1016/j.apacoust.2023.109819>
6. Suraj Prasad, **S. Narayanan** and Deepak Kumar Mandal, Bicomponent Drop's Evaporation:

Effect of Acoustics and Hot Surrounding, *Heat Transfer Engineering*, (2024), 1-14, <https://doi.org/10.1080/01457632.2024.2325276>

7. **Sushil Kumar Singh, Girija Shankar, Aadit Narayanmurthy, Kabilan Baskaran and S. Narayanan**, Effect of sawtooth trailing edge serrations on the reductions of airfoil broadband noise, *International Journal of Aeroacoustics*, (2024), 3, (1-2) 84-98

8. **Sushil Kumar Singh and S. Narayanan**, On the reductions of airfoil-turbulence noise by curved wavy serrations, *Physics of Fluids*, (2023), 35, 075140, ) <https://doi.org/10.1063/5.0152637>

9. **Sushil Kumar Singh and S. Narayanan**, Control of airfoil broadband noise through non-uniform sinusoidal trailing-edge serrations, *Physics of Fluids*, (2023), 35, 025139 <https://doi.org/10.1063/5.0133556>

10. **Aadil Kureshee, Deepak Kumar Mandal and S. Narayanan**, Twin bi-component drops' evaporation in an acoustic field: The amplitude influence, *Physics of Fluids*, (2023), 35, 032103; <https://doi.org/10.1063/5.0137944>

11. **Aadil Kureshee, S. Narayanan and Deepak Kumar Mandal**, Evaporation of twin drops: Effect of acoustics and spacing, *Physics of Fluids*, (2023), 35, 032103; <https://doi.org/10.1063/5.0137944>

12. **Sujit Kumar, Priyanshu Mishra, and S Narayanan**, Investigations of thickness effects on the acoustic characteristics of symmetric and asymmetric airfoils, *International Journal of Aeroacoustics* (2023), Vol. 0(0) 1–19, <https://doi.org/10.1177/1475472X23115260>

13. **Shailesh Kumar Jha and S. Narayanan**, On the acoustic emission characteristics of airfoils with different trailing edge configurations, *Proc IMechE Part G: J Aerospace Engineering*, (2022), Vol. 0 (0) 1–19, <https://doi.org/10.1177/09544100221141313>

14. **Ashish Narayan, Alok Kumar Sharma and S. Narayanan**, On the Reductions of Aerodynamic Drag and Heating of a Blunted Cone, *Iranian Journal of Science and Technology, Transactions of Mechanical Engineering*, (2022), <https://doi.org/10.1007/s40997-022-00563-4>

15. **Sujit Kumar, S. Narayanan**, Airfoil thickness effects on flow and acoustic characteristics, *Alexandria Engineering Journal*, (2022), 61, 4679-4699

16. **Sushil Kumar Singh, Mohit Garg, S. Narayanan, Lorna Ayton, and Paruchuri Chaitanya**, On the Reductions of Airfoil Broadband Noise through Sinusoidal Trailing-Edge Serrations, *Journal of Aerospace Engineering*, DOI: 10.1061/(ASCE)AS.1943-5525.0001386.

17. **Suraj Prasad, S. Narayanan, Deepak Kumar Mandal**, On the suppression of oscillatory circulation inside an evaporating bi-component drop through acoustic streaming, *International Journal of Multiphase Flow*, (2020), 129, 103314, 1-14 10.1016/j.ijmultiphaseflow. 2020.103314.

18. **Vartika Singh, Suraj Prasad, Ankit Das, S. Narayanan, Deepak Kumar Mandal**, Effect of spacing on evaporation and internal circulation of two identical drops, *Euro Physics Letters*, (2020), 131, 44001.

19. **S. Narayanan and Sushil Kumar Singh**, On the reductions of aerofoil-turbulence interaction noise through multi-wavelength leading edge serrations, *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, (2020), 235, 9, pp. 1036 –1052, <https://doi.org/10.1177/0954410020965747>.

20. **Ashish Narayan; S. Narayanan; Rakesh Kumar; Chintoo Sudhiesh Kumar; Gopalan Jagadeesh**, Hypersonic flow past a spherically blunted nose cone: a computational study, *Progress in Computational Fluid Dynamics, An International Journal*, (2020), 20, 2, pp.105 – 123, DOI: 10.1504/PCFD.2020.106410.

21. **Suraj Prasad, S. Narayanan, Deepak Kumar Mandal**, Acoustic induced flow around an

evaporating drop and its influence on internal circulation, *International Journal of Multiphase Flow*, (2019), 116, 91-99, 10.1016/j.ijmultiphaseflow.2019.04.012.

**22. Ashish Narayan, S. Narayanan, Rakesh Kumar, Tarandeep Singh, Chintoo S Kumar, Jagadeesh Gopalan,** Control of Aerodynamic drag and Heating of Nose cones through Taper Spikes, *Journal of Spacecraft and Rockets, AIAA Journal*, (2019), 1-12, DOI: 10.2514/1.A34250.

**23. Singh K Sushil, Mohit Garg and S Narayanan,** Estimation of the lower cut-off frequency of an anechoic chamber: An empirical approach, *International Journal of Aeroacoustics*, (2020), 19 (1–2), P-57–72.

**24. Shailesh Jha, S.Narayanan and L. A. Kumaraswamidhas** Investigations of flow phenomena behind a flat plate with circular trailing edge, *Journal of the Brazilian society of Mechanical Sciences and Engineering*, (2019), Vol. 41, No. 227, P-1-17.

**25. Shailesh Kr Jha, Uddipta Gautam, Pramod Pawar, S. Narayanan and L. A. Kumaraswamidhas** Investigations of Flow Phenomena Over a Flat Plate and NACA0012 Airfoil at High Angles of Attack, *Iranian Journal of Science and Technology, Transactions of Mechanical Engineering*, ((2019), 1-12. (<https://doi.org/10.1007/s40997-019-00313-z>).

**26. Amrit Kumar, Suraj, Priya Pal, S. Narayanan, Deepak Kumar Mandal,** Circulation inside a methanol – water drop evaporating in a heated atmosphere, *Colloid and Interface Science Communications*, 24, (2018), 82-86.

**27. S. Narayanan, A. Samanta, Ashish Narayan, Shailesh Kumar Jha,** Computational Study of Partially Covered Hartmann Whistle in a Sonic-Underexpanded Jet, , *Iranian Journal of Science and Technology, Transactions of Mechanical Engineering*, DOI 10.1007/s40997- 018-0232-3, (2018), 1-23.

**28. P. Chaitanya, P. Joseph, S. Narayanan, J. W. Kim,** Aerofoil broadband noise reductions through double-wavelength leading edge serrations; a new control concept, *Journal of Fluid Mechanics*, <https://doi.org/10.1017/jfm.2018.620>, 855, (2018), 131-151.

**29. P. Chaitanya, P. Joseph, S. Narayanan, C. Vanderwel, J. Turner, J. W. Kim and B. Ganapathisubramani,** Performance and mechanism of sinusoidal leading edge serrations for the reduction of turbulence–aerofoil interaction noise, *Journal of Fluid Mechanics*, 818 (2017), 435-464.

**30. Ashish Narayan, S.Narayanan, Rakesh Kumar,** Hypersonic flow past nose cones of different geometries: A comparative study, *Simulation: Transactions of the Society for Modeling and Simulation International*, DOI: 10.1177/0037549717733051, (2017), 1-16.

**31. Arnab Samanta, S Narayanan, Shailesh Kumar Jha and Ashish Narayan,** Numerical simulation of a sonic underexpanded jet impinging on a partially covered cylindrical Hartmann whistle, *Simulation: Transactions of the Society for Modeling and Simulation International*, DOI: 10.1177/0037549717741202, (2017), 1-15.

**32. S. Narayanan, P. Chaitanya, S. Haeri, P. Joseph, J. W. Kim, C. Polacsek,** Airfoil noise reductions through leading edge serrations, *Physics of Fluids*, 27, 025109 (2015).

**33. Edin Michael, S. Narayanan, Abdul Jaleel. H,** Numerical simulation of jet flow impinging on a shielded Hartmann whistle, *International Journal of Aeronautical and Space Sciences*, 16 (2) (2015) 123-136.

**34. S. Narayanan, K. Srinivasan, T. Sundararajan,** Aero-acoustic features of internal and external chamfered Hartmann whistles: A comparative study, *Journal of Sound and Vibration*, 333 (3) (2014) 774-787.

**35. S. Narayanan, K. Srinivasan, T. Sundararajan,** “Acoustic characteristics of external chamfered Hartmann whistles”, *Applied Acoustics*, 74 (2013) 1104–1116.

36. S. Narayanan, K. Srinivasan, T. Sundararajan, Effect of lip-thickness on the aero- acoustic features of Hartmann whistle, *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, (2014), 228(8) 1302–1313.
37. S. Narayanan, Bholanath Behera, T. Sundararajan, K. Srinivasan, Acoustic Heating Effects in Hartmann whistle, *International Journal of Aeroacoustics*, 12 (5 & 6) (2013) 97 –
38. S. Narayanan, K. Srinivasan, T. Sundararajan, Atomization in the acoustic field of a Hartmann whistle, *International Journal of Spray and Combustion Dynamics*, 5 (1) (2013), 1- 24.
39. K. Srinivasan, T. Sundararajan, S. Narayanan, T. J. S. Jothi, Acoustic Pyrometry in Flames, *Measurement*, 46 (1) (2013) 315–323.
40. S. Narayanan, K. Srinivasan, T. Sundararajan, K. Ramamurthi, Acoustic characteristics of chamfered Hartmann whistles, *Journal of Sound and Vibration*, 330 (2011) 2470-2496.
41. S. Narayanan, P. Bhawe, K. Srinivasan, K. Ramamurthi, T. Sundararajan, Spectra and directivity of a Hartmann whistle, *Journal of Sound and Vibration*, 321(2009) 875- 892.
42. K. Srinivasan, T. Sundararajan, S. Narayanan, T. J. S. Jothi, Effects of acoustic source and filtering on time-of flight measurements, *Applied Acoustics*, 70 (2009), 1061-1072. **(Featured among top 25 hottest articles in Applied Acoustics).**
43. G.J. Sreejith, S. Narayanan, T.J.S. Jothi, K. Srinivasan, Studies on conical and cylindrical resonators, *Applied Acoustics*, 69 (12) (2008) 1161-1175.
44. K. Srinivasan, S. Narayanan and O. P. Sharma, Numerical studies on erosive burning in cylindrical solid propellant grain, *Heat and Mass Transfer*, 44 (5) (2007) 579-585.

## PATENTS FILED/PUBLISHED/GRANTED

1. Joseph. P, **Subramanian. N**, Paruchuri. C, Kim. J-W, Multi-Frequency Leading Edge Serration for Reduced Aerofoil Noise, EP 3121 376 A1, dated 25/01/2017, bulletin 2017/04, US 2017/0022820 A1 dated jan 26, 2017, EP 3 121 376 B1, Date of publication and mention of the grant of the patent: 13.09.2017 Bulletin 2017/37, US 10301942 B2, May 28, 2019. **(Obtained Rolls Royce Inventor Award for this granted patent)**

### Rolls-Royce Inventor Awards for Southampton University

Dear Professor Astley

It gives me great pleasure to tell you that Southampton University will be awarded a total of £2250 under the provisions of the Rolls-Royce Awards to Inventors Scheme for 2015. This award represents the sum of payments that would have been made to the following inventors were they employees of Rolls-Royce. It is at your discretion whether the payments are passed on to the inventors

Stage	Case No.	Title	Application No. / Patent No.	Name	Award Amount
Stage 1	5882 JNR	Multi-Frequency Leading Edge Serration for Reduced Aerofoil Noise	1512688.1	Joseph, P	125
Stage 1	5882 JNR	Multi-Frequency Leading Edge Serration for Reduced Aerofoil Noise	1512688.1	Subramanian, N	125
Stage 1	5882 JNR	Multi-Frequency Leading Edge Serration for Reduced Aerofoil Noise	1512688.1	Paruchuri, C	125
Stage 1	5882 JNR	Multi-Frequency Leading Edge Serration for Reduced Aerofoil Noise	1512688.1	Kim, J-W	125
Stage 1	5895 LMT	Forming Shape Creator (FaSCo)	1513321.8	Cooper, D S - now an R-R employee	500

2. Suraj Prasad, Deepak Kumar Mandal and **S. Narayanan**, System and Method for Enhancing Evaporation rate of Multi component Drops by Acoustic Streaming, App. Number: 202231030421, TEMP/E-1/33830/2022- KOL (Filed).
3. Shailesh Kumar Jha, **S. Narayanan**, Sujit Kumar and Sushil Kumar Singh, An Improved Airfoil With Dimples for Noise Control, App. Number: 202231068071, TEMP/E-1/78307/2022- KOL (Filed).
4. Nandan Kumar Jha, Vikram, Adil Kureshee, Deepak Kumar Mandal, R. N. Hota and **S. Narayanan**, Acoustic Driven Twin jet Injector System For The Control of Sprays, Thermoacoustic Oscillations In a Combustor, App. Number: 202331082467, TEMP/E1/96730/2023- KOL (Filed).



5. Aadil Kureshee, Deepak Kumar Mandal, [S. Narayanan](#) and R. N. Hota, A System For Enhancing Evaporation Rate of Single and Multi Component Twin Drops by Acoustic Streaming, **App. Number: 202331084799, TEMP/E1/100582/2023- KOL (Filed).**
6. Sushil Kumar Singh, Manish Kant, [S. Narayanan](#) and Swagata Bhaumik, Airfoil With Wavy Leading and Trailing Edge Serrations For Enhancing the Reductions of Airfoil Broadband Noise, **App. Number: 202431005021, TEMP/E1/5736/2024- KOL (Filed)**
7. Aadit Narayanmurthy, Sushil Kumar Singh, Manish Kant, [S. Narayanan](#) and Swagata Bhaumik, Design and development of a low noise next generation airfoil with conventional wavy leading edge and curved wavy trailing edge tubercles for enhancing the mitigation of broadband noise, **App. Number: 202431058901, TEMP/E- 1/68425/2024-KOL (Filed)**
8. N. K. Jha, Vikram, N. K. Sah, [S. Narayanan](#), R. N. Hota, Novel acoustical measurement in combustion ducts to protect microphone from heat using specially designed waveguide. **Indian Patent (Filed)**

#### CONFERENCE PAPERS ACCEPTED / PUBLISHED

1. [S. Narayanan](#), [K. Srinivasan](#), and [T. Sundararajan](#), Acoustic characteristics of a cylindrical Hartmann resonator, [IISC Centenary International Conference and Exhibition on Aerospace Engineering](#), pp. 281-286, IISc, Bangalore, India, 18-22 May, 2009.
2. [S. Narayanan](#), [K. Srinivasan](#), and [T. Sundararajan](#), Aeroacoustic studies on chamfered resonance tubes, [AIAA-2009-703, 47th AIAA Aerospace Sciences Meeting](#), FL, 5-8 Jan, 2009.
3. [S. Narayanan](#), [K. Srinivasan](#), and [T. Sundararajan](#), Aeroacoustic features of cavities with chamfered outlets, [AIAA-2009-3351, 15th AIAA/CEAS Aeroacoustics Conference \(30th AIAA Aeroacoustics Conference\)](#), Miami FL, 11-13 May, 2009.
4. [S. Narayanan](#), [K. Srinivasan](#), [T. Sundararajan](#), Experimental study of the behavior of a single droplet and sprays in a sound field of Hartmann acoustic generator, [10th Asian Symposium On Visualization](#), pp. 324-332, SRM university campus Chennai - 603203, India, 1-5 Mar, 2010.
5. [S. Narayanan](#), [K. Srinivasan](#), and [T. Sundararajan](#), Effect of lip-thickness on the acoustic characteristics of Hartmann resonator, [AIAA-2010-3899, 16<sup>th</sup> AIAA/CEAS Aeroacoustics Conference](#), 7-9 Jun, 2010.
6. [G.J. Sreejith](#), [S. Narayanan](#), [T.J.S. Jothi](#), and [K. Srinivasan](#), “Studies on tapered resonance tubes” [AIAA-2007-3873, 37th AIAA Fluid Dynamics Conference and Exhibit](#), Miami, FL, June 25-28, 2007.
7. T. J. S. Jothi, S. Narayanan and K. Srinivasan, Image Processing for Quantifying Turbulent Plumes, [ASV064, Asian Symposium On Visualization](#), SRM university
8. [Edin Michael](#), [Abdul Jaleel](#), [S. Narayanan](#), Numerical studies on a shielded Hartmann whistle, [14th National Conference on Technological Trends](#), 30 - 31, August 2013, College of Engineering, Trivandrum.
9. [S. Narayanan](#), [P. Joseph](#), [S. Haeri](#), [J. W. Kim](#), Noise reduction studies from the leading edge of serrated flat plates, [20th AIAA/CEAS Aeroacoustics Conference, AIAA2014-2320](#).
10. [S. Haeri](#), [J. W. Kim](#), [S. Narayanan](#) and [P. Joseph](#), Numerical study of spectral serrations to reduce aerofoil-gust interaction noise, [20th AIAA/CEAS Aeroacoustics Conference, AIAA2014-2325](#).

11. **P. Chaitanya, S. Narayanan, P. Joseph, C. Vanderwel, J. W. Kim, B. Ganapathisubramani**, Broadband noise reductions through leading edge serrations on realistic aerofoils, [21st AIAA/CEAS Aeroacoustics Conference](#).
12. **P. Chaitanya, J. Gill, S. Narayanan, P. Joseph, C. Vanderwel, X. Zhang, B. Ganapathisubramani**, Aerofoil geometry effects on turbulence interaction noise, [21st AIAA/CEAS Aeroacoustics Conference](#).
13. **Chaitanya Paruchuri, S. Narayanan, Phillip Joseph, Jae Wook Kim**, Innovative leading edge geometries for improved leading edge noise reductions, ([Accepted for 22nd AIAA/CEAS Aeroacoustics Conference](#)).
14. **Arnab Samanta, S. Narayanan**, Numerical simulation of partially covered Hartmann whistle in a sonic-underexpanded jet, [3rd International Conference on Applications of Fluid Dynamics ICAFD-2016 held in 19-21 December 2016, IIT \(ISM\) Dhanbad, in association with Fluid Mechanics Group, University of Botswana, Botswana](#).
15. **Ashish Narayan, Rakesh Kumar and S.Narayanan**, “Computational study of hypersonic Flow past a spherically blunted nose cone” [International Journal of Applied Engineering Research](#)” July, 2016, IIT Mumbai, ICCMS -2016.
16. **Ashish Narayan, Rakesh Kumar and S. Narayanan** “Numerical investigation of hypersonic flow past a spherically blunted nose cone” [3rd International Conference on Applications of Fluid Dynamics ICAFD-2016 held in 19-21 December 2016, IIT \(ISM\) Dhanbad, in association with Fluid Mechanics Group, University of Botswana, Botswana](#).
17. **Shailesh Jha, S.Narayanan and L A Kumaraswamidhas**, Numerical Investigation of Subsonic Flow past a Flat Plate aerofoil, [3rd International Conference on Applications of Fluid Dynamics ICAFD-2016 held in 19-21 December 2016, IIT \(ISM\) Dhanbad, in association with Fluid Mechanics Group, University of Botswana, Botswana](#).
18. **Anurag Maheswari1, Shailesh Jha, S. Narayanan**, Vortex shedding behind a flat plate aerofoil with anti-singing trailing edge, [Second International conference on Mechanical and Manufacturing Engineering, \(ICMME 2017\) 6<sup>th</sup> and 7<sup>th</sup> April 2017, Sri Chandrashekharendra Saraswathi Viswa Mahavidyalaya, SCSVMV University, Enathur, Kanchipuram-631561, Tamilnadu, India](#).
19. **Piyush Kumar Pandey , Bhavna Rajput, Ashish Narayan, S.Narayanan**, Numerical simulation of supersonic flow past a bi-conic nose cone, [International conference on recent trends in civil engineering science and management, \(ICCSM-17\) from 24 to 26<sup>th</sup> March 2017, Guru Gobind Singh College of engineering and Research Centre, Nashik, MS, India](#).
20. **Bhavna Rajput, Piyush Kumar Pandey, Ashish Narayan, S. Narayanan**, **Computational study of supersonic flow past blunted tangent-ogive nose cone**, [3<sup>rd</sup> International conference on recent development in engineering science, humanities and management, \(ESHM-17\) 26<sup>th</sup> March 2017, National Institute of Technical Training and Research, Chandigarh, India](#).
21. **Uddipta Gautam, Shailesh Kr Jha, S.Narayanan and L.A. Kumaraswamidhas**, Comparative study of aerodynamic and aeroacoustic behavior of flat plate airfoils with different trailing edge geometry. [International conference on Advances in Thermal Systems, Materials and Design Engineering \(ATSMDE2017\), PAPER IDENTIFICATION NUMBER: AT\\_033, 1-6](#).
22. **Shailesh Jha, Uddipta Gautam, S. Narayanan, L. A Kumaraswami Dhas**, Effect of Reynolds Number on the Aerodynamic Performance of NACA0012 Aerofoil, [International Conference on Mechanical, Materials and Renewable Energy, IOP Conf. Series: Materials Science and Engineering 377 \(2018\) 012129 doi:10.1088/1757-899X/377/1/012129](#)
23. **Pramod Pawar, Rakesh Kumar Yadav and S. Narayanan**, Computational Study of Flow over a NACA 0012 Airfoil at Various Angles of Attack (**M1214**), **ICAME-2018**, MARCH 22-24, 2018 Department of Mechanical Engineering, SRM IST.



24. **Arnab Samanta, S. Narayanan, Ashish Narayan and Shailesh Kumar Jha**, Numerical Simulation of Partially Covered Hartmann Whistle in a Sonic-Underexpanded Jet, ICAFD-2016 published by Springer in *Lecture Notes in Mechanical Engineering*, [https://doi.org/10.1007/978-981-10-5329-0\\_15](https://doi.org/10.1007/978-981-10-5329-0_15), (2018), 227-238, (Indexed in scopus).
25. **Ashish Narayan, Rakesh Kumar and S. Narayanan**, Numerical Investigation of Hypersonic Flow Past a Spherically Blunted Nose Cone, ICAFD-2016 published by Springer in *Lecture Notes in Mechanical Engineering*, [https://doi.org/10.1007/978-981-10-5329-0\\_16](https://doi.org/10.1007/978-981-10-5329-0_16), (2018), 239-249, (Indexed in scopus).
26. **Shailesh Kumar Jha, S. Narayanan and L.A. Kumaraswamidhas**, Numerical Investigation of Subsonic Flow Past a Flat Plate Aerofoil, ICAFD-2016 published by Springer in *Lecture Notes in Mechanical Engineering*, [https://doi.org/10.1007/978-981-10-5329-0\\_17](https://doi.org/10.1007/978-981-10-5329-0_17), (2018) 251-260, (Indexed in scopus).
27. **Sushil Kumar Singh, Mohit Garg, Girija Shankar Tandon, Narayanan S**, Aerofoil broadband noise reductions through non-uniform wavy serrations, (2019), 64 *Indian Society of Theoretical and Applied Mechanics (ISTAM)*.
28. **Sujit Kumar, Alok Kumar Sharma, Roshmin Suresh K, Narayanan S**, Effect of nose radius on the aerodynamic characteristics of a NACA aerofoil, *Proceedings of the 7<sup>th</sup> International and 45<sup>th</sup> National Conference on Fluid Mechanics and Fluid Power (FMFP)*, December 10-12, (2018), IIT Bombay, Mumbai, India.
29. **Suraj Prasad, S. Narayanan, Deepak Kumar Mandal**, The effect of composition on the oscillatory internal circulation of an evaporating bi-component drop, Dec 28-31, (2019), *International Heat and Mass Transfer Conference (IHMTc)*, IIT Roorkee, 10.1615/IHMTc-2019.888.
30. **Suraj Prasad Amrit Kumar S. Narayanan and Deepak Kumar Mandal**, The Effect of the Size on the Oscillatory Internal Circulation for an Evaporating Methanol-Water Drop, 24 -27 Sep, (2018), *Thermophysics Conference AIP Conf. Proc. 1988, 020030-1–020030-6*, Slovakia, <https://doi.org/10.1063/1.5047624>.
31. **Aadil Kureshee S. Narayanan and Deepak Kumar Mandal**, How does the placement of an acoustic source influence a drop's evaporation? *Fluid Mechanics and Fluid Power conference, December 20-22, (2023), IIT Jodhpur, India*
32. **Aadit Narayanmurthy and S. Narayanan**, Acoustic emission characteristics of edge modified airfoils, *Fluid Mechanics and Fluid Power conference, December 20- 22, (2023), IIT Jodhpur, India*
33. **Sushil Kumar Singh and S. Narayanan**, Mitigation of airfoil broadband noise through wavy leading and trailing edge serrations: a novel bio-inspired noise control concept, *6<sup>th</sup> international congress of theoretical and applied mechanics (ICTAM 2024) (Accepted)*

#### **M-TECH THESIS SUPERVISED: MORE THAN 20 (SOME ARE LISTED BELOW)**

SI.N.o	Name of the student	Title of Dissertation
1.	Arnab Samanta	Computational study of partially covered Hartmann whistle in a sonic underexpanded jet
2.	Sujit Kumar	Computational study of sonic underexpanded jet impinging on a thin lipped cylindrical Hartmann resonator
3.	Santhosh Kumar	Simulation of supersonic flow past a cylindrical bluff body
4.	Kundan Kishore Jha	Study of jet impinging on a stepped cavity
5.	Krith Prakash	Investigations on jet flow interactions with a conical cavity
6.	Bhavna Rajput	Numerical investigation of supersonic flow past a blunted tangent ogive nose cone
7.	Piyush Kumar Pandey	Computational study of high speed flow past a bi-conic nose cone

8.	Anurag Maheswari	Numerical Simulation of flow past a flat plate airfoil with anti-singing trailing edge
9.	Navneet Varma	Computational study of Hartmann stem jet whistle in a sonic-underexpanded jet
10.	Uddipta Gautam	Experimental and computational study of flow over flat plates and its comparison with NACA airfoil
11.	Pramod Pawar	Numerical study of flow past NACA airfoils different wavy trailing edge configurations
12.	Rakesh Kumar Yadav	Numerical investigation on performance of NACA airfoil with sawtooth serrated trailing edges
13.	Roshmin Suresh	Effect of nose radius on the aerodynamic performance of a NACA0012 airfoil
14.	Alok Kumar Sharma	Effect of taper spikes on the reductions of aerodynamic drag and heating of a spherically blunted nose cone
15.	Ashish Anand	Effect of variable chord on the acoustic characteristics of a flat plate airfoil
16.	Avinash Kumar	Numerical investigation of two 10symmetric airfoils in tandem arrangement
17.	Girija Shankar Tandan	Aerofoil broadband noise reductions through V-Shaped Multi-wavelength Trailing Edge Serrations
18.	Sandeep Kumar Singh	Numerical Investigation of Hypersonic Flow Past Different Afterbody Configurations
19.	Akhil K C	Effect of Surface Roughness On the Flow and Acoustic Characteristics of A NACA Airfoil
20.	Roshan Kumar	Numerical investigations on thermal runaway of 18650 Lithium ion cell and 12s2p Battery pack with and without porous vent
21	Manish Kant	Control of fan broadband noise through wavy leading and trailing edge serrations

#### COMPLETED AND ONGOING PH.D. STUDENTS:

##### PhD Awarded / Completed:

1. **Sushil Kumar Singh**, IIT (ISM) Dhanbad (2023), Thesis: Control of airfoil broadband noise through wavy trailing edge serrations (**Sole guide**).
2. **Sujit Kumar**, IIT (ISM) Dhanbad (2023), Thesis: Investigations on symmetric and asymmetric NACA airfoils with different thickness ratios: Flow and acoustic characteristics (**Sole guide**)
3. **Shailesh Kumar Jha**, IIT (ISM) Dhanbad (2021), Investigations on flat plates and NACA airfoils with different trailing edge configurations: Flow and Acoustic Characteristics (**Main Guide**)
4. **Suraj Prasad**, IIT (ISM) Dhanbad (2021), Acoustic streaming effects on internal circulation and evaporation of single and multi-component drops (**Main Guide**)
5. **Ashish Narayan**, IIT (ISM) Dhanbad (2018), Investigations of hypersonic flow past different nose cone configurations: Aerodynamic drag and heating characteristics (**Co-guide**)

##### PhD Ongoing:

Mr. Aadil Kureshee	PhD	Ongoing ( <b>Main Guide, Expected to be completed in 2024</b> )
Mr. Aadit Narayan Murthy	PhD	Ongoing ( <b>Main Guide, Expected to be completed in 2025</b> )
Mr. Ankit Kumar	PhD	Ongoing ( <b>Co-Guide</b> )
Mr. Mithilesh Kumar	PhD	Ongoing ( <b>Co-guide</b> )
Mr. Piyush Kumar	PhD	Ongoing ( <b>Co-guide</b> )

## Completed and Ongoing sponsored R & D projects

### Projects completed:

1. On the reductions of aerofoil-turbulence noise by wavy edges, (**PI**), (Funding Agency DST (SERB), File No. ECR/2016/000640, *Sanctioned amount Rs 33.44 lakhs*)
2. Design and Fabrication of An Experimental Facility for Measurement of Acoustic Impedance of Afterburner Screech Liner, (**Co-PI**), (Funding Agency DRDO (GTRE), *Sanctioned amount Rs 99.5 lakhs*)
3. Experimental investigations on acoustic-droplet interactions, (**PI**), *FRS Institute Project, (Sanctioned amount Rs 9.35 lakhs)*
4. Acoustic characteristics of NACA airfoils with different trailing edge configurations, *Institute Mini Project, (Sanctioned amount Rs 2 lakhs)*

### Projects completing in Dec 2024

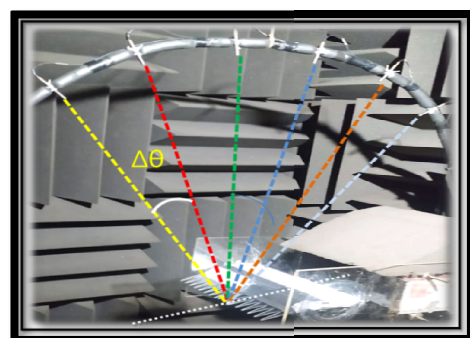
5. On the reductions of aerofoil turbulence noise through wavy leading and trailing edge serrations, (**PI**), (Funding Agency DST (SERB), File No. CRG/2021/000508, *Sanctioned amount Rs 34.1 lakhs*)

### Key Objectives:

The main aim of this proposal is to design and develop low noise airfoils that are effective in both low, moderate and high loading conditions of the fan blades, wind turbine blades and aircraft wings. **The idea is inspired from the “biomimetics” of barn owl wing which has wavy serrations at the leading edge (LE) and fringes at the trailing edge (TE).** The primary objective of the current project is to study the effect of (i) single wavelength and (ii) multiwavelength, wavy serrations introduced at the leading edge (LE) as well as the trailing edge (TE) of a NACA airfoils to reduce total far-field broadband noise emissions to develop **low noise next-generation airfoils** with the improved aerodynamic performance or minimum aerodynamic penalty, which finds numerous applications in the wind turbine blades, fan blades, open rotors, aircraft wings, etc.



*Fig. 1: Proposed new design of a quiet aerofoil of the next generation*



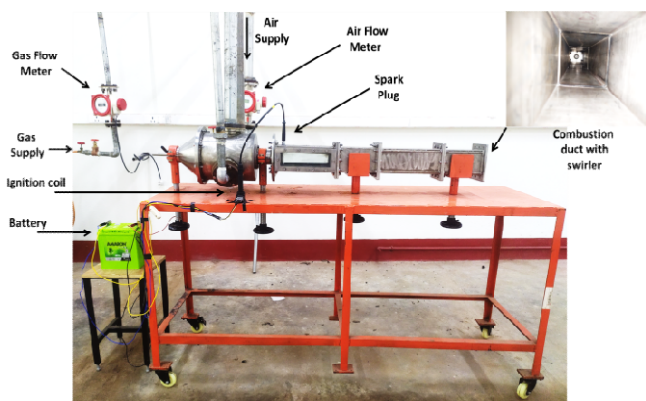
(A Patent filed for the newly developed airfoil to control the broadband noise)

Snap of the anechoic open jet wind tunnel facility developed at IIT (ISM) Dhanbad

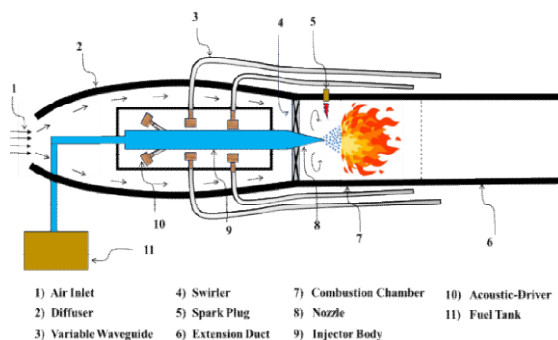
6. Control of sprays and thermo-acoustic oscillations through an acoustic driven fuel injector: passive and active control strategy, **(Co-PI)**, **(Funding Agency (Prestigious DST Scientific and Useful profound Research Advancement (SUPRA), File No. SPR/2020/000086, Sanctioned amount Rs 1.5 Crores)**

### Key Objectives:

The principal objective of this project is to **develop a novel twin injector with an acoustic driven secondary injection system for the control of prays and most of the thermo-acoustic instabilities since thermo-acoustic instabilities are broadband in nature and hence the complete elimination the instability is not yet achieved due to the presence of wide range of frequencies.** The proposed acoustic driven secondary fuel injection system will help to detect thermo-acoustic oscillation due to the abrupt combustion and to suppress the oscillation by sending counter acoustic signals (i.e., 180 degree out of phase) to the original signal, which will be monitored using acoustic sensors mounted at different locations on the combustor. Further, the acoustic drivers can enhance the atomization by mixing the fuel-air and improves the combustion efficiency.



Photograph of the newly designed Combustor Facility



Schematic of a twin jet acoustic driven fuel injector  
(Two patents filed in this project)

### Projects (Ongoing)

7. On the reductions of airfoil-turbulence noise through novel dimple configurations, **(Co-PI)**, **(Funding Agency DST (SERB), File No. CRG/2022/009108, Sanctioned amount Rs 53.3 lakhs).**

**This project is in joint collaboration with the Co-PI - Prof. K. Srinivasan, Department of Mechanical Engineering, IIT Madras. (Fund distribution: Rs 16,92350 to IIT Madras and Rs 36,37845 to IIT (ISM) Dhanbad)**

8. Biomechanical analysis on the use of Pulsating Liquid Jet in cement removal from the femoral canal in Revision Total Hip Arthroplasty: A novel approach for biomedical application, **(Co-PI)**, **(Funding Agency DST (SERB), File No. CRG/2022/000643, Sanctioned amount Rs 55.28 lakhs).**

**This project is in joint collaboration with the Co-PI – Dr. Manish Raj, Professor (Orthopaedics) All India Institute of Medical Sciences (AIIMS), Deoghar Deoghar, JHARKHAND, DEOGHAR**

**Key Objectives:**

One of the significant problems is debilitating arthritis which can be in the form of osteoarthritis, osteonecrosis, and rheumatoid arthritis. In this condition, severe pain, swelling, and degradation in functioning and motion of the hip joint take place. The remedy to this problem is Total Hip Arthroplasty (THA), the majority of which uses bone cement during the implantation of the femoral prosthesis. The bone cement function as grout and provide a tight mechanical interlock between the prosthetic femoral stem and the irregular bone surface of the femur. The removal of bone cement especially used in the distal fixation of implant stem in the femoral canal remains a challenging task for surgeons. Presently chisels, hammers, and other mechanical tools are used for cement removal from the femoral canal, which may cause intraoperative femoral fractures, cortical perforation, increased blood loss during surgery, and bone loss. Therefore, a new minimally invasive method for the extraction of bone cement from the femoral canal without damaging neighboring bones and tissues is needed. In this project, a critical investigation is proposed to use Pulsating Liquid jet (PLJ) technology as the non-thermal selective cutting and drilling with low tool diameter acting over small areas, which enables its use for minimally invasive treatment, thus decreasing intraoperative blood loss with fewer complications. The outcome of the project may lead to the possibility of the development of a hand-held prototype of PLJ tool for disintegrating bone cement during revision THA.