

DETAILED CURRICULUM VITAE OF PROF. SHRIPAD P. MAHULIKAR

1. *Personal Details:*

- (a) Name & Designation: *Prof. Shripad P. Mahulikar, Professor (Full)*
 (b) Date of Birth: *3rd September 1968* (c) Citizenship: *Indian*
 (d) Tel. *+91-22-25767122 (O), +91-22-25768122 (R), Mobile: +91-9619737122*

2. *Educational & Professional Qualifications (reverse chronological order):*

<u>No.</u>	<u>Deg. / Title</u>	<u>Institution</u>	<u>Year</u>	<u>Discipline</u>	<u>Class</u>
<i>i.</i>	Mercator Fellow	DFG-Mercator Professorship Programme	Dec'2011	Black-hole Thermodynamics	Non-Equilibrium
<i>ii.</i>	A. von Humboldt Fellow	Alexander von Humboldt Foundation, Germany	Jul'2003	Heat Transfer & Thermodynamics	Non-Equilibrium
<i>iii.</i>	Chartered Engineer	Engineering Council London, U.K.	Oct'2001	Reg. no. 470997 (with Membership of: <i>Royal Aero. Society, London</i>)	
<i>iv.</i>	Doctor of Philosophy (PhD)	Nanyang Technological University, Singapore	May'1999	Microscale Thermal & Fluids Science	Thesis adjudged Excellent
<i>v.</i>	Competent Toastmaster	Toastmasters' International Inc. USA	Feb'1999	Communication & Leadership	
<i>vi.</i>	Master of Technology (<i>by Res.</i>)	Indian Institute of Technology (IIT) Bombay	May'1992	Aerospace Engineering	I
<i>vii.</i>	Bachelor of Technology	IIT Bombay	Jul'1990	Aeronautical Engineering	I

3. *Work Experience & Research Collaborations (reverse chronological order):*

<u>No.</u>	<u>Organisation</u>	<u>Position</u>	<u>Period</u>	<u>Duties</u>
(1)	Indian Institute of Technology Kanpur, INDIA	Professor Visiting - inter-IIT exchange prog.	Dec'2017	<i>Academic Research & Special Lectures</i>
(2)	Indian Institute of Technology (IIT) Mandi, Himachal Province (H.P.), INDIA	Professor [on deputation (in public interest) from IIT Bombay]	Jun'2013 - Dec'2014	<i>Academic Research, & Higher Education, Guiding Jr. Faculty</i>
(3)	<i>Hamburg University of Technology, GERMANY</i>	<i>DFG-Mercator Full Prof. Visiting</i>	<i>Dec'2011 – Dec'2012</i>	<i>Academic Research & Higher Education</i>
(4)	<i>Gyeongsang National University, S. KOREA</i>	<i>On Special Invitation</i>	<i>Dec'2010, May-Jun'10</i>	<i>Academic Research & Special Lectures</i>

(5)	<i>Hamburg University of Technology, GERMANY</i>	<i>A. von Humboldt Fellow (3rd Term)</i>	<i>Apr'2009 - Jul'2009</i>	<i>Academic Research & Special Lectures</i>
(6)	Indian Institute of Technology (IIT) Bombay, INDIA	Professor (Full): Aerospace Dept.	Feb'2009 onwards	Academic Research & Higher Ed.
(7)	<i>China Jiliang University, P.R. CHINA</i>	<i>On Special Invitation</i>	<i>Dec'2008 & Jun'2005</i>	<i>Academic Research & Special Lectures</i>
(8)	IIT Bombay, INDIA (Dept. of Aerospace Engineering)	Associate Professor	Mar'2005 - Feb'2009	Academic Research & Higher Education
(9)	<i>Hamburg University of Technology, GERMANY</i>	<i>A. von Humboldt Fellow (2nd Term)</i>	<i>Apr'2007 - Jul'2007</i>	<i>Academic Research</i>
(10)	<i>Aalto University, Helsinki, FINLAND</i>	<i>Visiting Professor</i>	<i>May'2006 - Jun'2006</i>	<i>Academic Research & Higher Education</i>
(11)	<i>Hamburg University of Technology, GERMANY</i>	<i>A. von Humboldt Fellow (1st Term)</i>	<i>Jul'2003 - Aug'2004</i>	<i>Academic Research & Special Lectures</i>
(12)	IIT Bombay, INDIA (Dept. of Aerospace Engineering)	Assistant Professor	Jan'2000 - Feb'2005	Academic Research & Higher Education
(13)	Nanyang Technological University (NTU) SINGAPORE	Post-Doctoral Research Fellow	Dec'1999 - Jan'2000	Academic Research
(14)	NTU Singapore (School of Mech. & Aerospace Engineering)	Research Engineer	Oct'1998 - Nov'1999	Academic Research
(15)	Naval College of Engineering, INS Shivaji, Lonavla, INDIA	Scientist 'C'	Jul'1995 - Nov'1995	Training & R&D
(16)	Naval College of Engineering, INS Shivaji, Lonavla, INDIA	Scientist 'B'	Dec'1993 - Jun'1995	Training & R&D
(17)	Defence Research & Development Laboratory, INDIA	Scientist 'B'	Feb'1992 - Dec'1993	R&D
(18)	IIT Bombay, INDIA (Dept. of Aeronautical Engineering)	Senior Research Scientist	May'1990 - Jul'1990	R&D

Kindly Note –

a) Appointment, Sr. no. (2) in IIT Mandi H.P. was on deputation (in public interest) from IIT-Bombay Sr. no. (6).

Following five [b) – f)] appointments outside IIT Bombay after Jan'2000 (italicised below & in above table) are collaborations -

b) Appointment in Hamburg Univ. Tech. Sr. no. (3), funded by DFG's Mercator Professorship programme, grant no. T-ZW-M21-DFG-1131, is during Sabbatical Leave from IIT Bombay [Sr. no. (6)].

c) Invitation in Gyeongsang Nat. Univ. Sr. no. (4), funded by Priority Research Centers Program, National Research Foundation of Korea, grant no. 2009-0094016, was during vacation from Sr. no. (6).

d) Invitation in China Jiliang Univ. Sr. no. (7), funded by Foreign Experts' Program for Scientific Research, Zhejiang Province, P.R. China, grant no. 2008-607, was during vacation from Sr. no. (8).

e) Appointment in Aalto University Sr. no. (10), funded by Aalto Univ.'s Visiting Professorship program, was during vacation from Sr. no. (8).

f) A. von Humboldt Fellowship's (grant no. 1104249/INI) 1st, 2nd, & 3rd terms, Sr. nos. (10), (8), & (4), respectively, were on deputation from IIT Bombay, Sr. nos. (12), (8), & (6), respectively.

g) Awarded performance bonus for service at NTU – Singapore [Sr. nos. (14) & (13)].

h) Work experience from Sr. nos. (17) - (15), included the successful completion of Government of India's educational scholarship bond period of 3-years.

- i) Change of work place, Sr. no. (17) → (16), is an inter-departmental transfer; & change of positions, Sr. nos. (16) → (15), (12) → (8), & (8) → (6), are promotions within the organisation.

4. List of Research Publications (reverse chronological order):

a. Journal Publications:

- 1) Rajan K. & **Mahulikar S.P.** 2019 Variable fluid property effect on heat transfer and frictional flow characteristics of water flow through micro-channel, *Journal of Engineering Thermophysics*, accepted (w. PhD student).
- 2) Tharkar A.D. & **Mahulikar S.P.** 2019 The mean temperature difference method for micro heat exchanger analysis considering property variation, *Heat Transfer Engineering*, 40(8), doi: 10.1080/01457632.2018.1436510, in press (w. PhD student).
- 3) Pallavi R. & **Mahulikar S.P.** 2018 Theoretical studies on energy degradation estimation and minimization in laminar convective flow towards the micro-scale, *Heat Transfer – Asian Research*, in press, doi: 10.1002/htj.21357 (w. PhD student).
- 4) Pallavi R. & **Mahulikar S.P.** 2018 (Aug) Entropy generation in laminar forced convective overloading of a single tube towards the micro-scale, *ASME Journal of Energy Resources Technology*, 140(8), 082002, 8-pgs. (w. PhD student).
- 5) Rajan K. & **Mahulikar S.P.** 2018 (Apr) Physical effects of variable thermophysical fluid properties on flow and thermal development in micro-channel, *Heat Transfer Engineering*, 39(4) 374-390 (w. PhD student).
- 6) Pallavi R. & **Mahulikar S.P.** 2018 (Apr) Optimization of micro-heat sink based on theory of entropy generation in laminar forced convection, *International Journal of Thermal Sciences*, 126, 96-104 (w. PhD student).
- 7) Rajan K. & **Mahulikar S.P.** 2017 (Nov) Physical effects of variable fluid properties on laminar gas-micro-convective flow, *Heat Transfer - Asian Research*, 46(7) 1029-1040 (w. PhD student).
- 8) Rajan K. & **Mahulikar S.P.** 2017 (Jul) Numerical re-examination of Chilton-Colburn analogy for variable thermophysical fluid properties, *ASME Journal of Heat Transfer*, 139(7) 071701, 10-pgs. (w. PhD student).
- 9) Sachin K. & **Mahulikar S.P.** 2017 (Mar-Apr) Design of thermal protection system for reusable hypersonic vehicle using inverse approach, *AIAA Journal of Spacecraft & Rockets*, 54(2) 436-446 (w. PhD student).
- 10) Sachin K. & **Mahulikar S.P.** 2016 (Nov) Aero-thermal analysis for configuration design of swept leading edge of hypersonic vehicle, *ASCE Journal of Aerospace Engineering*, 29(6) 04016057, 9-pgs. (w. PhD student).
- 11) Baranwal N. & **Mahulikar S.P.** 2016 (Oct-Dec) Infrared signature of aircraft engine with choked converging nozzle, *AIAA Journal of Thermophysics & Heat Transfer*, 30(4) 854-862 (w. PhD student).
- 12) **Mahulikar S.P.** & Pallavi R. 2016 (Oct), Study of black-hole as dissipative structure using negentropy, *Canadian Journal of Physics*, 94(10) 960-966 [also ref. (i) scientific press-release in Sci-Tech. Sect. of India Today's, Daily Opinion: <<http://www.dailyo.in/technology/black-holes-iit-bombay-stephen-hawking-entropy-negentropy/story/1/12262.html>>; (ii) IIT-Bombay's Brochure, Glimpses of Research: http://www.ircc.iitb.ac.in/IRCC-Webpage/rnd/PDF/GlimpseIITBResearch/ADDRESSING_ANOMALY_AND_MISSING_LINK_IN_HAWKING_THEORY_ON_BLACK_HOLE_THERMODYNAMICS.pdf].
- 13) Sachin K. & **Mahulikar S.P.** 2016 (Sep-Oct) Aero-thermal analysis of lifting body configurations in hypersonic flow, *Acta Astronautica*, 126, 382-394 (w. PhD student).

- 14) Sachin K. & **Mahulikar S.P.** 2016 (Jun) Reconstruction of aero-thermal heating and thermal protection material response of a Reusable Launch Vehicle using inverse method, *Applied Thermal Engineering*, 103, 344-355 (w. PhD student).
- 15) Sachin K. & **Mahulikar S.P.** 2016 (Jun) Selection of materials and design of multilayer light weight passive thermal protection system, *ASME Journal of Thermal Science & Engineering Applications*, 8(2) 021003, 9 pgs. (w. PhD student).
- 16) Baranwal N. & **Mahulikar S.P.** 2016 (Jan) IR signature study of aircraft engine for variation in nozzle exit area, *Infrared Physics & Technology*, 74, 21-27 (w. PhD student).
- 17) Rajan K. & **Mahulikar S.P.** 2015 (Sep) Frictional flow characteristics of micro-convective flow for variable fluid properties, *Fluid Dynamics Research*, 47(6) 065501, 21-pgs. (w. PhD student).
- 18) Rajan K. & **Mahulikar S.P.** 2015 (Aug) Effects of temperature-dependent viscosity variation on fully developed laminar microconvective flow, *International Journal of Thermal Sciences*, 98, 179-191 (w. PhD student).
- 19) Yogish K.N. & **Mahulikar S.P.** 2015 (Feb) Performance optimization of co-current gas-to-gas micro heat exchanger considering radiation, *Heat Transfer Engineering*, 36(3) 244-261 (w. Masters' student).
- 20) Baranwal N. & **Mahulikar S.P.** 2014 (Dec) Aircraft engine's infrared lock-on range due to back pressure penalty from choked convergent nozzle, *Aerospace Science & Technology*, 39, 377-383 (w. PhD student).
- 21) Prabhu S.V. & **Mahulikar S.P.** 2014 (Dec) Effects of density and thermal conductivity variations on entropy generation in gas micro-flows, *International Journal of Heat & Mass Transfer*, 79, 472-485 (w. PhD student).
- 22) **Mahulikar S.P.** & Kumari P. 2014 (Sep) Scale-invariant entropy-based theory for dynamic ordering, *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 24(3) 033120, 6-pgs.
- 23) Sonawane H.R. & **Mahulikar S.P.** 2013 (Mar-Apr) Effect of missile turn rate on aircraft susceptibility to IR guided missile, *AIAA Journal of Aircraft*, 50(2), pp. 663-666 (w. PhD student).
- 24) **Mahulikar S.P.** & Herwig H. 2013 (Jan) Thermodynamic analysis of a Schwarzschild black-hole fed by cosmic microwave background radiation, *European Physical Journal C: Particles & Fields*, 73(1) 2292, 8 pgs.
- 25) **Mahulikar S.P.** & Herwig H. 2012 (Oct) Exact solution for energy analysis of Schwarzschild black-hole fed by CMBR, *Astrophysics & Space Science*, 341(2) 417-420.
- 26) **Mahulikar S.P.**, Gulhane N.P., Pradhan S.D., Hrisheekesh K., & Prabhu S.V. 2012 (Jul-Sep), Pressure drop characteristics in continuum-based laminar compressible micro-convective flow, *Nanoscale & Microscale Thermophysical Engineering*, 16(3) 181-197.
- 27) **Mahulikar S.P.**, Vijay S., Potnuru S.K., & Reddam, D.N.S. 2012 (Jul), Aircraft engine's lock-on envelope due to internal and external sources of infrared signature, *IEEE Transactions on Aerospace & Electronic Systems*, 48(3) 1914-1923.
- 28) Gulhane N.P. & **Mahulikar S.P.** 2012 (Jun) Numerical investigation on laminar micro-convective liquid flow with entrance effect and Graetz problem due to variation in thermal properties, *Heat Transfer Engineering*, 33(8) 748-761 (w. PhD student).
- 29) Sonawane H.R. & **Mahulikar S.P.** 2011 (Jun) Tactical air warfare: Generic model for aircraft susceptibility to infrared guided missiles, *Aerospace Science & Technology*, 15(4) 249-260 (w. PhD student).
- 30) Gulhane N.P. & **Mahulikar S.P.** 2011 (Jan-Mar) Numerical study of microconvective water-flow characteristics with variations in properties, *Nanoscale & Microscale Thermophysical Engineering*, 15(1) 28-47 (w. PhD student).
- 31) **Mahulikar S.P.**, Herwig H., Zhou J.W., & Sodhani Y.M. 2011 (Jan) Surface radiative transfer in gas-to-gas cocurrent micro heat exchanger, *AIChE Journal*, 57(1) 40-50.

- 32) **Mahulikar S.P.**, Kumar R., Tripathi M.S., & Pasari L.K. 2010 (Dec) A modified dimensionless number and geometric symmetry in annulus convection with viscous dissipation, *International Journal of Heat & Mass Transfer*, 53(25-26) 5976-5983.
- 33) Gulhane N.P. & **Mahulikar S.P.** 2010 (May) Numerical study of compressible convective heat transfer with variations in all fluid properties, *International Journal of Thermal Sciences*, 49(5) 786-796 (w. PhD student).
- 34) **Mahulikar S.P.** & Herwig H. 2009 (Aug) Exact thermodynamic principles for dynamic order existence and evolution in chaos, *Chaos, Solitons & Fractals*, 41(4) 1939-1948 [cited in Wikipedias: (i) 'Negentropy' <<http://en.wikipedia.org/wiki/Negentropy>>, (ii) 'Entropy in thermodynamics' <http://en.wikipedia.org/wiki/Entropy_in_thermodynamics_and_information_theory>].
- 35) **Mahulikar S.P.**, Potnuru S.K., & Rao G.A. 2009 (Apr) Study of sunshine, skyshine, and earthshine for aircraft infrared detection, *Journal of Optics A: Pure & Applied Optics*, 11(4) 045703, 10 pgs. [cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>].
- 36) Gulhane N.P. & **Mahulikar S.P.** 2009 (Mar) Variations in gas properties in laminar micro-convection with entrance effect, *International Journal of Heat & Mass Transfer*, 52(7-8) 980-1990 (w. PhD student).
- 37) **Mahulikar S.P.**, Khurana S., Dungarwal R., Shevakari S.G., Subramanian J., & Gujarathi A.V. 2008 (Oct-Dec) Transient aero-thermal mapping of passive thermal protection system for nose-cap of reusable hypersonic vehicle, *Journal of the Astronautical Sciences*, 56(4) 593-619.
- 38) **Mahulikar S.P.**, Prasad H.S.S., & Potnuru S.K. 2008 (May-Jun) Infrared signature suppression of helicopter engine duct based on 'conceal and camouflage', *AIAA Journal of Propulsion & Power*, 24(3) 613-618 (cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>).
- 39) **Mahulikar S.P.** & Herwig H. 2008 (Mar) Fluid friction in incompressible laminar convection: Reynolds' analogy revisited for variable fluid properties, *European Physical Journal B: Condensed Matter & Complex Systems*, 62(1) 77-86 (cited in Wikipedia: 'Reynolds analogy' <http://en.wikipedia.org/wiki/Reynolds_analogy>).
- 40) **Mahulikar S.P.**, Herwig H., & Hausner O. 2007 (Dec) Study of gas microconvection for synthesis of rarefaction and nonrarefaction effects, *IEEE / ASME Journal of Microelectromechanical Systems*, 16(6) 1543-1556.
- 41) **Mahulikar S.P.**, Sonawane H.R., & Rao G.A. 2007 (Oct-Nov) Infrared signature studies of aerospace vehicles, *Progress in Aerospace Sciences*, 43(7-8) 218-245 [cited in Wikipedias: (i) 'Stealth technology' <http://en.wikipedia.org/wiki/Stealth_technology>, (ii) 'Stealth aircraft' <http://en.wikipedia.org/wiki/Stealth_aircraft>, (iii) 'Infrared' <<http://en.wikipedia.org/wiki/Infrared>>, (iv) 'Infra-red search and track' <http://en.wikipedia.org/wiki/Infra-red_search_and_track>, (v) 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>].
- 42) **Mahulikar S.P.**, Potnuru S.K., & Kolhe P.S. 2007 (Aug) Analytical estimation of solid angle subtended by complex well-resolved surfaces for infrared detection studies, *Applied Optics*, 46(22) 4991-4998 (cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>).
- 43) Zhou J.-W. & **Mahulikar S.P.** 2006 (Oct-Dec) Cooling characteristics during bath quenching of test probe using inverse heat transfer, *Experimental Heat Transfer*, 19(4) 297-308 (from: collaboration with China Jiliang Univ.).
- 44) Herwig H. & **Mahulikar S.P.** 2006 (Oct) Variable property effects in single-phase incompressible flows through microchannels, *International Journal of Thermal Sciences*, 45(10) 977-981 (from: A. von Humboldt Fellowship).
- 45) **Mahulikar S.P.** & Herwig H. 2006 (Sep) Physical effects in pure continuum-based laminar micro-convection due to variation of gas properties, *Journal of Physics D: Applied Physics*, 39(18) 4116-4123.
- 46) **Mahulikar S.P.** & Herwig H. 2006 (Jul) Physical effects in laminar microconvection due to variations in incompressible fluid properties, *Physics of Fluids*, 18(7) 073601, 12-pgs.

- 47) **Mahulikar S.P.**, Rao G.A., & Kolhe P.S. 2006 (Jan-Feb) Infrared signatures of low flying aircraft and their rear fuselage skin's emissivity optimization, *AIAA Journal of Aircraft*, 43(1) 226-232 (cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>).
- 48) Rao G.A. & **Mahulikar S.P.** 2005 (Nov) New criterion for aircraft susceptibility to infrared homing missiles, *Aerospace Science & Technology*, 9(8) 701-712 (w. PhD student) (cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>).
- 49) **Mahulikar S.P.** 2005 (Nov) Theoretical aerothermal concepts for configuration design of hypersonic vehicles, *Aerospace Science & Technology*, 9(8) 681-685 [refs. *Research Matters* (magazine), dated 12.Apr'18: <https://researchmatters.in/news/thermal-design-reusable-hypersonic-vehicles-rhv>; *Deccan Herald* (daily news-paper), dated 8.May'18: <https://www.deccanherald.com/spectrum/science/future-hypersonic-flight-668738.html>; *Deccan Chronicle* (daily news-paper), dated 27.May'18: <https://www.deccanchronicle.com/decaf/270518/into-the-future-fast-low-cost-flying-machine.html>; *The Asian Age* (daily news-paper), dated 1.Jun'18: <http://www.asianage.com/decaf/010618/into-the-future-fast-low-cost-flying-machine.html>].
- 50) **Mahulikar S.P.** & Sane S.K. 2005 (Sep) Theoretical analysis of experimentally observed perplexing calibration characteristics of ball-in-vortex flow-meter, *ASME Journal of Fluids Engineering*, 127(5) 1021-1028.
- 51) **Mahulikar S.P.**, Rao G.A., Sane S.K., & Marathe A.G. 2005 (Jul-Sep) Aircraft plume infrared signature in non-afterburning mode, *AIAA Journal of Thermophysics & Heat Transfer*, 19(3) 413-415 (cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>).
- 52) Rao G.A. & **Mahulikar S.P.** 2005 (Jul-Aug) Effect of atmospheric transmission and radiance on aircraft infrared signatures, *AIAA Journal of Aircraft*, 42(4) 1046-1054 (w. PhD student) (cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>).
- 53) **Mahulikar S.P.**, Kolhe P.S., & Rao G.A. 2005 (Jan-Mar) Skin temperature prediction of aircraft rear fuselage with multi-mode thermal model, *AIAA Journal of Thermophysics & Heat Transfer*, 19(1) 114-124 (cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>).
- 54) **Mahulikar S.P.** & Herwig H. 2005 (Jan) Theoretical investigation of scaling effects from macro-to-microscale convection due to variations in incompressible fluid properties, *Applied Physics Letters*, 86(1) 014105, 3-pgs.
- 55) **Mahulikar S.P.**, Herwig H., Hausner O., & Kock F., 2004 (Dec) Laminar gas micro-flow convection characteristics due to steep density gradients, *Europhysics Letters*, 68(6) 811-817.
- 56) **Mahulikar S.P.** & Herwig H. 2004 (Oct) Conceptual investigation of the entropy principle for identification of directives for creation, existence and total destruction of order, *Physica Scripta*, 70(4) 212-221.
- 57) Rao G.A. & **Mahulikar S.P.** 2002 (Dec) Integrated review of stealth technology and its role in airpower, *Aeronautical Journal*, 106(1066) 629-641 (w. PhD student) [cited in Wikipedias: (i) 'Stealth technology' <http://en.wikipedia.org/wiki/Stealth_technology>, (ii) 'Stealth aircraft' <http://en.wikipedia.org/wiki/Stealth_aircraft>, (iii) 'Infrared signature'- <http://en.wikipedia.org/wiki/Infrared_signature>].
- 58) **Mahulikar S.P.** & Tso C.P. 2002 (Mar) A new classification for thermal-development of fluid flow in a circular tube under laminar forced convection, *Proceedings of the Royal Society (London) Series A: Mathematical, Physical & Engineering Sciences*, 458(2019) 669-682.
- 59) **Mahulikar S.P.**, Sane S.K., Gaitonde U.N., & Marathe A.G. 2001 (Apr) Numerical studies of infrared signature levels of complete aircraft, *Aeronautical Journal*, 105(1046) 185-192 (cited in Wikipedia: 'Infrared signature' <http://en.wikipedia.org/wiki/Infrared_signature>).
- 60) Tso C.P. & **Mahulikar S.P.** 2000 (May) Experimental verification of the role of Brinkman number in microchannels using local parameters, *International Journal of Heat & Mass Transfer*, 43(10) 1837-1849 (from PhD Thesis).

- 61) Tso C.P. & **Mahulikar S.P.** 2000 (Mar) Combined evaporating meniscus-driven convection & radiation in annular microchannels for electronics cooling application, *International Journal of Heat & Mass Transfer*, 43(6) 1007-1023 (from PhD Thesis).
- 62) Tso C.P. & **Mahulikar S.P.** 1999 (Jul-Sep) View factors between finite length rings on an interior cylindrical shell, *AIAA Journal of Thermophysics & Heat Transfer*, 13(3) 375-379 (from PhD Thesis).
- 63) Tso C.P. & **Mahulikar S.P.** 1999 (May) The role of the Brinkman number in analysing flow transitions in microchannels, *International Journal of Heat & Mass Transfer*, 42(10) 1813-1833 (from PhD Thesis).
- 64) Tso C.P. & **Mahulikar S.P.** 1999 (Jan-Mar) View factor for ring elements on coaxial cylinders, *AIAA Journal of Thermophysics & Heat Transfer*, 13(1) 155-158 (from PhD Thesis).
- 65) Tso C.P. & **Mahulikar S.P.** 1998 (Jun) The use of the Brinkman number for single phase forced convective heat transfer in microchannels, *International Journal of Heat & Mass Transfer*, 41(12) 1759-1769 (from PhD Thesis).
- 66) Tso C.P. & **Mahulikar S.P.** 1996 (Dec) Simulation of evaporating meniscus-driven flow for application to electronics cooling design, *Journal of Electronics Manufacturing*, 6(4) 231-241 (from PhD Thesis).

Research monograph:

Gulhane N.P. & **Mahulikar S.P.** 2011, *Laminar Micro-Convection of Gas and Liquid*, ISBN 978-3-8433-9189-4, LAP Lambert Academic Publishing GmbH & Co. KG, Saarbrücken, F.R. Germany, 144 pgs. (w. PhD student).

b. Conference Publications & Keynote / Invited Lectures:

- 1] **Mahulikar S.P.**, Rao G.A., Sonawane H.R., & Pallavi R. 2018 (May) *Keynote Lect.* Numerical model for aircraft susceptibility to infrared guided missiles, *Proceedings of 6th International Workshop on Numerical Modeling in Aerospace Sciences (NMAAS-2018)*, Bucharest, Romania.
- 2] **Mahulikar S.P.**, Rao G.A., & Sonawane H.R. 2018 (Feb) *Invited Lect.* Model for aircraft susceptibility to infrared guided missiles, *Proceedings of International Conference & Expo on Aerospace & Aeronautical Engineering*, Abu Dhabi, UAE.
- 3] Prabhu S.V. & **Mahulikar S.P.** 2017 (Dec) An alternate approach to friction factor computations based on entropy generation in gas micro flows, *Proc. of International Conference on Advances in Thermal System, Materials & Design Engineering*, V.J.T.I. Mumbai, India, pap. no. AT_007 (w. PhD student).
- 4] Tharkar A.D. & **Mahulikar S.P.** 2017 (Dec) The new mean temperature difference method for micro heat exchanger analysis considering property variation, *Proc. of International Conf. on Adv. in Thermal System, Materials & Design Engineering*, V.J.T.I. Mumbai, India, pap. no. AT_008 (w. PhD student).
- 5] **Mahulikar S.P.** & Pallavi R. 2017 (Nov) *Invited Lect.* 'Black-hole as dissipative structure using negentropy,' *Proceedings of A. von Humboldt Foundation's Colloquium - "Germany & India - Partners in Education & Research"*, The Leela Palace - Bangalore, India (lect. no. 336).
- 6] **Mahulikar S.P.**, Sachin K., Pallavi R., Khurana S., & Dunganarwal R. 2017 (Sep) *Plenary Lect.* 'Additional aerothermal concepts for configuration design of lifting-body of hypersonic reusable vehicle,' *Proceedings of XXIV AIDAA (Associazione Italiana di Aeronautica e Astronautica) International Conference (Palermo - Enna, Italy)*, pap. id: 34.
- 7] **Mahulikar S.P.** 2017 (Jun) *Invited Lect.* 'Theoretical model for aircraft susceptibility to infrared guided missiles', 11th *National Frontiers of Engineering Symposium (NatFOE)*, IIT-Bombay, Mumbai, India.
- 8] **Mahulikar S.P.** 2016 (Mar) *Keynote Lect.* 'Surface radiation exchange in micro-heat exchanger: benign or parasitic?' *9th International Conf. on Thermal Engineering Theory & Applications*, Abu Dhabi, U.A.E.
- 9] **Mahulikar S.P.** 2015 (Oct) *Invited Lect.* 'Infrared signatures of aerospace vehicles', *International Conf. on Aerospace Eng.* (in: *World Congress on Engineering & Technology CET-2015*), Suzhou, P.R. China.
- 10] **Mahulikar S.P.** 2013 (Feb) *Invited Lect.* 'Aircraft susceptibility to infrared guided missiles using lock-on vs. lethal envelop,' *Low Observables' Technology Conference*, Yonsei University, Seoul, S. Korea.

- 11] **Mahulikar S.P.**, Gulhane N.P., Pradhan S.D., & Prabhu S.V. 2011 (Jul) *Keynote Lect.* 'Pressure drop in laminar micro-convective flow due to variable properties of compressible fluid', *Proceedings of 7th International Conference on Computational Heat and Mass Transfer*, Istanbul, Turkey.
- 12] **Mahulikar S.P.**, Rao G.A., Sonawane H.R., & Prasad H.S.S. 2009 (Aug) *Invited Lect.* 'Infrared signature studies of aircraft and helicopters' (pap. no. 090107203540), *Proceedings of Progress in Electromagnetics Research Symposium (PIERS-2009)*, Moscow.
- 13] **Mahulikar S.P.** & Herwig H. 2008 (Jun-Jul) *Invited Lect.* Fluid property variations in micro-convection, *8th World Congress on Computational Mechanics*, Venice, Italy; in: *Advances in multiphysics simulation & experimental testing of MEMS & NEMS (ID: 151)*, ed. A. Frangi, N. Aluru, S. Mukherjee.
- 14] **Mahulikar S.P.**, Rao G.A., Sonawane H.R., Potnuru S.K., Kolhe P.S., & Prasad H.S.S. 2008 (Jun) *Invited Lect. (IT-9)*: 'Infrared signature studies of airborne targets', *Proceedings of International Conference on Aerospace Science & Technology*, Bangalore, India.
- 15] **Mahulikar S.P.** & Herwig H. 2005 (Jun) 'Modified thermodynamic principles unifying order existence and evolution', *Proceedings of 18th International Conference on Efficiency, Cost, Optimization, Simulation, and Environmental Impact of Energy Systems (ECOS)*, Trondheim, Norway; ed. S. Kjelstrup, J.E. Hustad, T. Gundersen, A. Røsjorde, G. Tsatsaronis (Tapir Uttrykk, Norway), pp. 295-302.
- 16] Herwig H. & **Mahulikar S.P.** 2005 (Jun) 'Variable property effects in single-phase incompressible flows through micro-tubes', *Proceedings of 3rd International Conference on Microchannels & Minichannels*, Toronto, Canada, pap. no. ICMM 2005-75082 (from: A. von Humboldt Fellowship).
- 17] **Mahulikar S.P.**, Herwig H., Hausner O., & Kock F., 2005 (May) 'Scaling effects in continuum-based laminar gas micro-flow convection due to variation of gas properties', *Proceedings of 4th International Conference on Computational Heat & Mass Transfer*, Paris-Cachan, France, ed. R. Bennacer, A.A. Mohamad, M. El-Ganaoui, J. Sicard (Lavoisier, France), pap. no. 120.
- 18] Rao G.A. & **Mahulikar S.P.** 2005 (Jan) 'Aircraft power-plant and plume infrared signature modelling and Analysis', *Proceedings of 43rd AIAA Aerospace Sciences Meeting & Exhibits*, Reno Nevada, U.S.A. pap. no. AIAA-2005-0221 (w. PhD student).
- 19] Rao G.A. & **Mahulikar S.P.** 2004 (Nov) 'Review of stealth technology and aircraft IR signatures', *Proceedings of 7th National Conference on Air Breathing Engines & Aerospace Propulsion*, IIT-Kanpur, India, pp. 345-358 (w. PhD student).
- 20] **Mahulikar S.P.**, Herwig H., & Hausner O. 2004 (Mar) 'Numerical simulation of 1-D incompressible laminar microscale convection behaviour with temperature dependent fluid properties', *Applied Mathematics & Mechanics (GAMM-2004 Conference)*, Dresden, Germany), vol. 4(1), pp. 488-489.
- 21] **Mahulikar S.P.**, Herwig H., & Hausner O., 2003 (Sep) 'Identification of critical scope: comprehensive review of microscale convection', *Proceedings of 9th International Workshop on Thermal Investigations of ICs & Systems*, Aix-en-Provence, France (TIMA Lab, Grenoble, France), pp. 7-30.
- 22] **Mahulikar S.P.** 2003 (Jun) *Invited pap.* 'New analyses and concepts for aerodynamic heating to critical surfaces of hypersonic vehicle', *Proceedings of Confederation of European Aerospace Societies (CEAS): Aerospace Aerodynamics Research Conference*, London, U.K. pp. 20.1 - 20.12.
- 23] **Mahulikar S.P.** 2003 (Feb) *Invited Lect.* 'Stealth technology and its' role in current geopolitics', *Proceedings of XXVI Indian Social Science Congress*, Andhra University, Visakhapatnam, India.
- 24] **Mahulikar S.P.** & Dungarwal R. 2002 (Aug) Numerical simulation of forward stagnation region temperature field of reusable hypersonic vehicle, *5th Annual CFD Symposium*, Bangalore, India, CP-23.
- 25] **Mahulikar S.P.** 2002 (Feb) *Invited pap.* 'High performance cooling using microchannels for coming generation applications', *DRDO Workshop on Propulsion Systems*, HEMRL-Pune, India, pp. 159-168.
- 26] **Mahulikar S.P.**, Sane S.K., & Marathe A.G. 2002 (Jan) 'Analysis of thermo-fluid issues in fuel cooling of electronics in aircraft', *Proceedings of International Symposium on Recent Trends in Heat & Mass Transfer*, IIT-Guwahati, India, pap. no. ISRTHMT 02-126.

- 27] Sane S.K., **Mahulikar S.P.**, Marathe A.G., & Jha A.K. 2000 (Sep) 'Analytical investigation of calibration non-linearity of ball-in-vortex flowmeter', *Proceedings of Global Conference on Flow-metering & Control for New Millennium*, Palakkad-Kerala, India, pp. 127-134.
- 28] Tso C.P. & **Mahulikar S.P.** 1999 (Oct) 'A survey on coupled transport processes in thin liquid films for microchannel heat transfer application', *5th International Workshop on Thermal Investigations of ICs & Microstructures*, Rome-Italy (TIMA Lab, Grenoble, France), pp. 56-62 (from PhD thesis).
- 29] Tso C.P. & **Mahulikar S.P.** 1999 (Jun) 'Multimode heat transfer in a two-dimensional microchannel', *Proceedings of Pacific Rim / ASME International, Intersociety Electronic Packaging Conference*, Maui-Hawaii, USA (ASME, USA), vol. 26-2, pp. 1229-1233 (from PhD thesis).
- 30] Tso C.P. & **Mahulikar S.P.** 1998 (Dec) 'Laminar convection behaviour in microchannels in conventional thermal entry length & beyond', *Proceedings of 2nd IEEE Electronics Packaging Technology Conference*, Singapore (IEEE, Piscataway, NJ, USA), pp. 126-132 (from PhD thesis).
- 31] Tso C.P. & **Mahulikar S.P.** 1998 (Sep) 'Numerical simulation of coupled flow & evaporating meniscus-driven convection in annular microchannels', *Proceedings of 3rd High Performance Computing Asia Conference*, Singapore, pp. 732-739 (from PhD thesis).
- 32] Tso C.P. & **Mahulikar S.P.** 1997 (Dec) 'Semi-analytical study of coupled heat transfer & flow due to evaporating meniscus in annular microchannels for electronics cooling', *2nd International Seminar on Fluid Mechanics & Heat Transfer*, Dhaka-Bangladesh, pp. 9-16 (from PhD thesis).
- 33] Tso C.P. & **Mahulikar S.P.** 1997 (Dec) 'Coupled fluid flow & heat transfer due to an evaporating meniscus in annular microchannels', *Proceedings of 7th Asian Congress of Fluid Mechanics*, Chennai (Madras)-India, pp. 757-760 (from PhD thesis).
- 34] **Mahulikar S.P.** 1993 (Apr) 'Prediction of transmissivity of the intervening atmosphere for infrared signature studies', *Proceedings of SAE's Aerospace Atlantic Conference*, Dayton-Ohio, USA (SAE, Warrendale, PA, USA), SAE Technical pap. no. 931413.
- 35] **Mahulikar S.P.** 1992 (Apr) Prediction of engine casing temperature of fighter aircraft for infrared signature studies, *Proceedings of SAE's Aerospace Atlantic Conference*, Dayton-Ohio, USA (SAE, Warrendale, PA, USA), SAE Technical pap. no. 920961 (1-10).
- 36] **Mahulikar S.P.** 1992 (Apr) Philosophical approach to the basic understanding of the mechanics of jet propulsion, *Proceedings of SAE's Aerospace Atlantic Conference*, Dayton-Ohio, USA (SAE, Warrendale, PA, USA), SAE Technical pap. no. 920960 (1-7).

c. Reviewer / Advisor for Scientific Journals:

Aerospace Science & Technology, AIAA Journal of Propulsion & Power, AIAA Journal of Thermophysics & Heat Transfer,

ASME Journal of Heat Transfer (received: Outstanding Reviewer Award - 2007),

Chemical & Biochemical Engineering Quarterly, Computer Modeling in Engineering & Sciences, Defence Science Journal, Heat and Mass Transfer (Wärme- und Stoffübertragung), Heat Transfer Engineering, Infrared Physics & Technology, International Journal of Heat & Mass Transfer, International Journal of Thermal Sciences, Journal of Process Mechanical Engineering (Proc. I. Mech. E. Part E), Measurement, Microelectronics Journal, Microfluidics & Nanofluidics, Proceedings of the Royal Society (London) Series A: Mathematical, Physical & Engineering Sciences

5. Claims of Seminal Contributions in Research (in reverse chronological order)

- a) Analyzed entropy generation (\dot{S}_{gen}) in laminar forced convective flow towards micro-scale [ref. 4.a.(3),(4),(6)]: The \dot{S}_{gen} en-route the micro-scale is studied for laminar fully developed water flow in a circular tube. For a given rate of heat removal using a fixed total mass flow rate of coolant (water): (*i*)

Number of tubes (N) en-route microscale is increased by decreasing each tube diameter (D_N). At an optimum D_N and corresponding N (a natural number), sum-total \dot{S}_{gen} ($\dot{S}_{\text{gen,tot}}$) is found to be minimum; (ii) A single circular tube is “convectively (= thermal + flow) overloaded” towards micro-scale by decreasing D . Since, $\dot{S}_{\text{gen,tot}}$ is found to remain about the same towards microscale, it is worth overloading a tube for miniaturization up to the laminar-flow limit.

- b) Theoretically proved that black-hole is a thermodynamic dissipative structure [ref. 4.a.(12)]: The area of the event horizon of black-hole (A_{eh}) is linked to the black-hole’s *negentropy*, which encompasses its entropy. Increasing A_{eh} of black-holes that grow now follows from the *Negentropy Theorem (NET)*. The decreasing A_{eh} of black-holes that decay follows from the *Converse to NET* & is not a violation of the *Area Theorem*. The *Corollary to NET* is proved for the case when two dissipative structures merge, which is the basis for the coalescence of black-holes.
- c) Analyzed the role of aircraft engine’s back-pressure penalty due to choked convergent nozzle on the Infra-Red (IR) signature levels from the rear aspect [ref. 4.a. (10), (16), (20)]: Reduction in the exit area of choked convergent nozzle reduces the visibility (subtended solid-angle) of internal hot surfaces of the engine. Hence, *for the same engine operating point*, i.e. reduced thrust, IR-signature from the rear aspect reduces. But *for the same thrust*, the engine operating point must be shifted to higher combustion temperature, which increases the IR-signature. In the latter case, the net effect of reduction in the exit area of choked convergent nozzle is to increase the IR-signature of the engine from the rear aspect.
- d) Developed thermodynamic theory for formation, sustenance, & destruction of dissipative structures / self-organization process [ref. 4.a. (22), (34), & (56)]: Thermodynamic principles were analysed for deducing 9-theorems based on the broken symmetry spelled by the Entropy Principle (EP) & the Law of Maximum Entropy Production. Negentropy was re-defined, based on which, theorems for order existence (Negentropy Principle) & order evolution (Principle of Maximum Negentropy Principle: PMNEP) were identified. The PMNEP encompasses the concepts in the evolution postulates by Darwin & de Vries. Following the introduction of “*Isolated Embedding System*”, dynamic order formation, sustenance, & destruction are thermodynamically analysed. A model for ordering based on the mass / energy exchange with the surroundings is introduced, which explains ‘*negentropy debt*’. The entropy & specific entropy of order & that of mass & / or energy exchanged by it, form the basis for the model. Existence & destruction of order are analysed based on a sustainability criterion that links these parameters. Thermodynamic basis is given for the co-existence of superior & inferior forms of order.
- e) Derived the rate of energy & entropy variation of a Schwarzschild black-hole fed by Cosmic Micro-wave Background Radiance (CMBR) [ref. 4.a.(24), (25)]: This unique solution holds for both growth (evolution) & decay, which are bifurcated by the critical initial mass (it depends on the temperature of CMBR). The entropy analysis revealed that there is a higher value of black-hole’s critical mass than that obtained from an energy analysis, which is needed for its existence.
- f) Proved that laminar incompressible flow characteristics are also influenced by temperature-dependent thermal properties of fluid [ref. 4.a.(26)]: Pressure drop (Δp) characteristics differ at low Reynolds number & high heat flux. The Δp -variation in low subsonic micro-convective flow is non-linear due to temperature-sensitivity of density. Air density [$\rho(p, T)$] & viscosity [$\mu(T)$] variations directly affect & increase the wall shear stress (τ_w), Fanning & Darcy friction factors (f_f , f_b), & Δp . Thermal conductivity & specific heat variations indirectly affect by non-negligibly decreasing τ_w , f_f , Δp , & f_b .

- g) Identified that surface radiation in micro-heat exchanger can improve its performance [ref. 4.a.(31)]: Radiation is beneficial in tubular micro heat exchanger & not parasitic as known in the conventionally-sized heat exchanger. Radiation makes available additional surface area for convection to the annulus flow, thereby increasing the specific heat transfer surface for fixed geometry. Hence, a high emissivity layer over the surfaces of micro heat exchanger can improve its performance. The active heat transfer area weighted by the convection rates is introduced as the measure of heat exchanger compactness.
- h) Identified another dimensionless number & geometric symmetry in annulus convection with viscous dissipation [ref. 4.a.(32)]: Nusselt & Brinkman numbers by themselves were shown to be incomplete for describing convection with viscous dissipation; therefore, another dimensionless number combining them is introduced. This number directly links convection with viscous dissipation & shrinks the complexity of mathematical analysis. When the different boundary conditions on the two annulus walls are interchanged, the solution can be obtained using *reciprocal of aspect ratio of annulus* in place of *aspect ratio*, in the earlier solution (termed as the *inverse aspect ratio symmetry*).
- i) Master-minded the stealth-design of indigenous IR-suppressor for Advanced Light Helicopter (ALH), c/o Rotary Wing Research & Design Centre, Hindustan Aeronautics Ltd. [ref. 4.a.(38)]: IR-suppressor based on optical blocking (concealing) of the engine hot-parts (without increasing the back-pressure penalty on the engine) & camouflaging of exposed surfaces of the suppressor was designed.
- j) Re-examined validity of Reynolds' analogy for variable properties of water [ref. 4.a.(39)]: The inverse dependence of Reynolds number with the Fanning friction factor (f) is the basis for the validity of the Reynolds' analogy in laminar internal flow. This can lead to the unexpected outcome of Reynolds' analogy resulting in Stanton number *increasing* with *decreasing* f . A new dimensionless number is identified that correlates with the Poiseuille number, when fluid viscosity-variations are significant.
- k) Developed methodology for analytically estimating the solid-angle subtended by complex surfaces of aircraft engine layout [ref. 4.a.(42)]: The methodology is quick yet accurate for estimation of solid-angle subtended by aircraft engine layouts. It is based on the *Parallel Rays Projection* method, & is accurate for large distances between IR-detector & target aircraft / missile.
- l) Identified the Heat-Transfer-Minimized-Sweepback & Thermally-Benign Sharp Swept-Back Leading Edge Effect, for Reusable Hypersonic Vehicle [ref. 4.a. (10), (13), (49)]: It was proved that the sweepback angle at which the temperature of SBLE is minimum is not the same as the drag minimised sweepback angle. Further, though blunting of the leading edge is popularly believed to reduce its temperature, for SBLE this holds only up to a certain sweepback angle (Λ_{crit}). Beyond Λ_{crit} , sharper leading edge gives lower temperature, which is termed as the '*thermally benign sharp SBLE effect*'.
- m) Identified physical effects due to variations of incompressible [refs. 4.a.(54) & 4.a.(46)] & compressible fluid properties [ref. 4.a.(55) & 4.a.(45)] in laminar micro-convection: In micro-convection, the effects of variations in properties '*along the flow*' were found to be significant relative to '*over the cross-section*'. The induced radial flow due to fluid viscosity & density variations, modified axial convection, & induced axial conduction in fluid were found to determine the micro-convection characteristics.
- n) Identified the concept of thermal un-development of flow [ref. 4.a.(58)]: The reverse process of flow development also occurs in heat & momentum transport, termed as '*flow un-development*'.

6. Other Relevant Academic & Professional Information:

a. Membership of Professional Organisations (reverse chronological order):

No.	Society / Foundation / Academy / Club	Grade	Period
i.	Aeronautical Society of India (<i>AeSI</i>)	Life Fellow (no. F-833)	Aug'2016 - Life
ii.	<i>AeSI</i> Mumbai Branch	Vice Chairman	Jan-Dec'2016
iii.	Institution of Engineers' (India)	Life Fellow (no. F-116247-7)	Aug'2011 - Life
iv.	Alexander von Humboldt Foundation, Germany	Life Fellow (no. INI-1104249)	Jul'2003 - Life
v.	Indian Academy of Social Sciences	Life Fellow (no. 812)	May'2003 - Life
vi.	Royal Aeronautical Society, London	Member (no. 1334074)	May'2000 - date
vii.	NTU - School of Mechanical & Aerospace Eng. (MAE) Graduate Research Club, Singapore	Chairman	Jan-Oct'1998
viii.	NTU-MAE Graduate Research Club, Singapore	Dy. Chairman & Secretary	Jan'1996 – Dec'1997
ix.	<i>AeSI</i>	Life Member (no. M.2656)	Feb'1995 – Jul'2016

b. Awards / Recognitions / Honours (reverse chronological order):

- i) Nominated by Hon'ble Governor of Maharashtra (India) on Academic Council of Solapur University (public university) from Feb'2018 to Aug'2022, as per Sect. 32(3)(i) of Maharashtra Public Universities Act – 2016, vide Governor's office letter no. CS/Solapur/AC/2018/CR-0026/190 dated 24.Jan'2018.
- ii) Nominated by Ministry of Human Resource Development - Government of India, as Expert in Aerospace Engineering in 2017–18, for Selection of candidates for award of Commonwealth Scholarship in U.K.
- iii) DFG funded Mercator Chair Professorship (Visiting) in T.U. Hamburg-Harburg, Germany; 1.Dec'2012 – 31.Dec'2012.
- iv) IIT Bombay's Review Paper Award – 2009, for: Mahulikar *et al.* 2007, Infrared signature studies of aerospace vehicles, *Progress in Aerospace Sci.* 43(7-8), 218-245.
- v) Member of Board of Studies for post-graduate program in Air Armament, *Defence Institute of Advanced Technology*, Pune, India (June'2008 – May'2010).
- vi) Excellence Award for 2007, from Aerospace Engineering Association, IIT Bombay, dated 4.Mar'2008.
- vii) Outstanding Reviewer Award for ASME Journal of Heat Transfer (one of the two leading journals in discipline) for the year 2007 (given to best five reviewers on 13.Nov'2007).
- viii) A. von Humboldt Fellowship, F.R. Germany; 1.Jul'2003 onwards.

7. Doctorate Level Thesis Supervision: (all as, Main Guide):

No.	Student	Title / Topic of thesis	Completion Year / In progress)	Co-guide
1.	Vijay H. Shinde	Aerothermal studies for Reusable Hypersonic Vehicle	In Progress (from IIT Bombay)	None
2.	Pallavi Rastogi	Entropy generation studies in laminar convective flow from mini to microscale	In Progress (from IIT Bombay)	None
3.	Ankush D. Tharkar	Theoretical and numerical studies on micro-heat exchanger	In Progress (from IIT Bombay)	None
4.	Nidhi Baranwal	Infrared signature of jet nozzle in off-design operation of combat aircraft engine	2018 (from IIT Mandi HP)	for Admin. only

5.	Sachin Kumar	Aero-thermal mapping of passive thermal protection system for reusable hypersonic vehicle	2017 (from IIT Mandi HP)	for Admin. only
6.	Rajan Kumar	Study of laminar micro-convective flow with variable fluid properties	2017 (from IIT Mandi HP)	for Admin. only
7.	Sharad V. Prabhu	Entropy production in laminar micro-convective flow with variations in fluid properties	2016 (from IIT Bombay)	None
8.	Hemant R. Sonawane	Infrared signature susceptibility and suppression studies of aircraft	2013 (from IIT Bombay)	None
9.	Nitin P. Gulhane*	Studies on laminar micro-convection of liquid & gas with variations in fluid properties	2010 (from IIT Bombay)	None
10.	G. Arvind Rao†	Infrared signature level studies of aircraft	2006 (from IIT Bombay)	None

**Received:* Excellence in PhD Thesis Award from IIT Bombay. *Presently:* Assoc. Professor & Head of Mech. Engineering @ VJTI, Mumbai, India.

†*Presently:* Assoc. Professor, Faculty of Aerospace Engineering @ T.U. Delft, The Netherlands.

7.(b) Classroom Teaching at IIT-Bombay, India: Aerospace Heat Transfer (UG & PG⁺), Aircraft Propulsion (UG & PG), Communication & Leadership (PG), Heat Transfer - Fundamentals (UG), Spaceflight Mechanics (UG), Thermodynamics & Propulsion Fundamentals (UG).

I. *Introduced the following experiments in Propulsion Laboratory curriculum (UG & PG):*

- i) Study of convective heat transfer to bent cylinder (bi-curvature forward stagnation region),
- ii) Study of convective heat transfer to swept-cylinder.

II. Conducted 5-days' Short Term Course for Quality Improvement Program (QIP) & Continuing Education Program (CEP code: CEP/2017-18/I-11) participants entitled, "*Aircraft Stealth Technology*", 10-14.Nov'2017 (45-participants).

7.(c) Classroom Teaching at T.U. Hamburg-Harburg, Germany (as DFG-Mercator Chair Professor): Special Topics in Thermodynamics & Heat Transfer (PG)

7.(d) Classroom Teaching at IIT Mandi H.P. (on deputation from IIT-Bombay): Stealth Technology, Aircraft Propulsion

7.(e) Important Administrative Activities at IIT-Bombay:

- i) Member - Aerospace Department Post-Graduate (PG) Committee (DPGC) = Jan'2002 – Jun'2003, Sep'2004 – Jun'2007, Jan'2018 - date
- ii) Faculty In-charge, Aerospace Engineering Association, IIT-Bombay: Mar'2016 – Jun'2018

iii) Member – Department Policy Committee: Apr’2015 – Mar’2018

iv) Member – Department Faculty Screening & Search Committee: Aug’2015 – Mar’2018

v) Member –Library Committee: 2010 – Nov’2011

vi) Member - Aerospace Department Under-Graduate (UG) Committee (DUGC) = Jun’2008 – Nov’2011

vii) Post-Graduate Admissions Coordinator of Aerospace Department = Feb-Nov’2011

8. Sponsored & Consultancy Theoretical Research Projects Undertaken as Principal Investigator:

<u>Sponsoring Agency</u>	<u>Title of Project</u>	<u>Amount of Grant (INR)*</u>	<u>Period</u>	<u>Co-investigators</u>
Turkish Aerospace Industries (TAI) Inc. Ankara	Academic Consultant on - Infrared stealth design of Turkish National Fighter Aircraft (TF-X); no. DRD/AE/SPM-1/17-18	12,00,000/-	Jul’2017 (for 10-working days)	None
Foreign Experts’ Program, P.R. China	Exploratory studies on micro-heat transfer & non-equilibrium thermodynamics	3,00,000/-	2016	Prof. Jing-Wei Zhou, China Jiliang Univ. P.R. China
SRIC (Seed Grant), IIT Mandi, India	Non-equilibrium thermodynamics of dissipative structures (no. IITM/SG/SPM/28)	5,00,000/-	2013-14	None
Industrial Research & Consultancy Centre, IIT-Bombay, India (Review Paper Award 2009)	(i) Academic research on IR signatures of aerospace vehicles; (ii) Academic research on laminar micro-convection; (iii) Academic research on non-equilibrium thermodynamics	4,95,000/- (Proj. code = 10IRAWD005; no. RI/0210-10000483-001)	2010-19	None
German Research Foundation – Mercator Chair Professorship	Non-equilibrium thermodynamics of dissipative structures & black-hole thermodynamics (award no. T-ZW-M21-DFG-1131)	72,00,000/-	2012	Prof. H. Herwig, T.U. Hamburg-Harburg, F.R. Germany
Low Observables’ Research Centre, Seoul, S. Korea	Exploratory studies on infrared signatures of aircraft & helicopters	4,90,000/-	2010	Prof. Rho-Shin Myong, GNU, S. Korea
A. von Humboldt Foundation, Germany	Radiation modelling in micro-heat exchanger (no. 1104249/INI)	9,80,000/-	2009	Prof. H. Herwig, T.U. Hamburg-Harburg, F.R. Germany
Foreign Experts’ Program, P.R. China	Radiative heat transfer in micro-sized geometries	4,70,000/-	2008	Prof. Jing-Wei Zhou, China Jiliang Univ. P.R. China

A. von Humboldt Foundation, Germany	Reynolds' analogy for variable properties flow (no. 1104249/INI)	6,60,000/-	2007	Prof. H. Herwig, T.U. Hamburg-Harburg, F.R. Germany
Aalto University, Finland	Osmotic pressure driven micro-capillary flow / Non-equilibrium thermodynamics	13,60,000/-	2006	Prof. M. Lampinen, Thermodynamics Lab. Finland
A. von Humboldt Foundation, Germany	Laminar micro-convection with variable fluid properties (no. 1104249/INI)	33,30,000/-	2003-04	Prof. H. Herwig, T.U. Hamburg-Harburg, F.R. Germany
Gas Turbine Research Establishment, Bangalore, India	Audit of thermal design of Hindustan Aeronautics Ltd.'s Digital Electronic Control Unit (in Academic Consultancy mode)	57,500/-	2002	Prof. S.K. Sane & A.G. Marathe
Rotary Wing Research & Design Centre (RWR&DC), India	Development of indigenous infrared signature suppressor for engine exhaust duct of Advanced Light Helicopter (in Academic Consultancy mode, no. 09AE016)	4,60,000/-	2001-11	Prof. S.K. Sane – Caretaker during, A. von Humboldt Fellowship's 1 st Term
Aeronautics R&D Board (ARDB, Aerodynamics Panel), India	Analytical solution for Nusselt number in laminar annular flows with viscous dissipation term (no. 01AB001)	2,44,000/-	2001-03	Prof. A.G. Marathe – Caretaker during, A. von Humboldt Fellowship
Defence R&D Laboratory, Hyderabad, India	Aerothermal studies in hypersonic flows for reusable hypersonic vehicle (no. 01DD001)	4,99,000/-	2001-03	Prof. A.G. Marathe, Caretaker during, Humboldt Fellowship
ARDB (Propulsion Panel), India	Infrared signature level studies of military aircraft (no. 01AB002)	2,97,200/-	2001-03	Prof. A.G. Marathe – Caretaker during, Humboldt Fellowship
IRCC (Seed Grant), IIT Bombay, India	Investigation of calibration non-linearity of ball-in-vortex flow-meter (no. 00IR007)	50,000/-	2000-01	Prof. S.K. Sane

The above grant amount in Indian Rupees (INR) is for theoretical & numerical / academic research projects & does not include amount to support postgraduate (Masters' & PhD) research students. This amount is provided by the Ministry of Human Resources Development, Govt. of India, as Teaching Assistantship.

9. *Invited Lectures in Universities / Research Organisations* (reverse chronological order)

<i>Lecture Title</i>	<i>University / Organisation</i>	<i>Date</i>
Aerothermal concepts for configuration design of lifting-body of Reusable Hypersonic Vehicle	Politehnica Univ. Bucharest - Faculty of Aerospace Eng. Romania	May'2018

Non-equilibrium thermodynamics of black-hole using its negentropy	Indian Institute of Technology (IIT) Kanpur, India	Dec'2017
Numerical modelling of radiation & convection in micro-heat exchanger	VJTI - Mumbai, India (@ Short Term Course)	Feb'2017
Non-equilibrium thermodynamics of open systems	Indian Institute of Technology (IIT) Kanpur, India	Apr'2016
IR signature prediction & suppression studies	Defence Lab. Jodhpur, India	Mar'2016
Pressure drop in laminar micro-convective flow with variable properties of compressible fluid	Defence Research & Development Laboratory, Hyderabad, India	Jun'2015
Scale-invariant entropy-based theory for dynamic ordering	IIT Hyderabad, India	Oct'2014
Black-hole as thermodynamic dissipative structure	IIT Mandi (Institute Colloquium Lecture), HP India	Apr'2014
Review of infrared signatures of aerospace vehicles	National Institute of Technology, Hamirpur, HP India	Jul'2013
Infrared (IR) signature susceptibility of aircraft	Yonsei Univ. Seoul, S. Korea	Feb'2013
IR signature studies of aerospace vehicles	Bilkent Univ. Ankara, Turkey	Sep'2012
Role of surface radiative transfer in co-current micro-heat exchanger	Arçelik A.Ş. R&D Center, Istanbul, Turkey	Sep'2012
Thermodynamic principles for self-organisation in isolated embedding systems	Institute for Social & Economic Change, Bangalore, India	Oct'2011
Laminar micro-convective flow characteristics due to variable properties of compressible fluid	Istanbul Technical Univ. Turkey	Jul'2011
Role of thermodynamics in dynamic ordering	Indian Institute of Astro. Bangalore	Feb'2011
IR signature studies of aerospace vehicles	Gyeongsang N. Univ. Jinju, S. Korea	Dec, Jun 2010
Role of thermodynamics in ordering / Laminar micro-convection with fluid property variations	Institut National des Sciences Appliquées de Toulouse, France	Jun'2009
Exact thermodynamic principles for dynamic order existence and evolution in chaos	T.U. Delft (Faculty of Aerospace Engineering), The Netherlands	Jun'2009
Role of thermodynamics in dynamic ordering / Laminar micro-convection with incompressible fluid property variations	T.U. Wien, Austria (Institute of Fluid Mechanics & Heat Transfer - Colloquium Lecture)	May'2009 / Mar'2004
Role of thermodynamics in dynamic order existence and evolution	Technische Universität Hamburg-Harburg, Germany	May'2009
Investigation on infrared (IR) signatures of aircraft & helicopters	Aeronautical Development Agency, Bangalore, India	Jan 2009
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