# ANOOP KANJIRAKAT

Mechanical Engineering Program
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## Education

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| **2005-2010** | **Ph. D.** Mechanical Engineering, Indian Institute of Technology Madras, India.<br>*Thesis topic: Studies on Thermo-physical transport in nanofluids* |
| **2000-2002** | **M. Tech,** Thermal Science, NIT Calicut, Kerala, India.<br>*Thesis topic: Analysis of gas-particle flow through a nozzle and its impingement on a flat Surface.* |
| **1995-1999** | **B. Tech,** Mechanical Engineering M. A College of Engineering, M.G. University, Kerala, India.<br>*Thesis topic: Fluidized swirling bed for pepper drying.* |

## Professional experiences

**Asst. Research Scientist** **2013 –present**

Presently working as Asst. Research Scientist in MSTF Lab investigating impingement characteristics of micro droplets for electronic cooling applications.

**Post-Doctoral Research Associate** **2009- 2013**

Worked in Sustainable Energy Research Laboratory at TAMUQ investigating the Computational Fluid Dynamics part of the solar thermal methane cracking process. Developed two-phase,3D, unsteady CFD models including chemical kinetics, heat transfer and solar flux using FLUENT. Worked in the Micro Scale Thermo Fluids Laboratory at TAMUQ, investigating the convective and near-wall flow characteristics of nanofluids. Near-wall flow measurements are made using nano-Particle Image Velocimetry method.

**Research Associate** **2007- 2008**

Worked as Research Associate in Thermodynamic Laboratory, HSU Hamburg Germany, as part of exchange program under DAAD fellowship (German Academic Exchange program)-PhD sandwich model, including four months intensive language learning (Deutsch). The research work involved thermal conductivity measurement using Guarded Hot plate method as well as investigating the turbulent convective heat transfer characteristics of nanofluids.

**Project Officer** **2004- 2007**

Worked as Project Officer, for a project funded by Dept of Science and Technology, India at IIT Madras. Designed and developed an experimental setup for studying the laminar convective heat transfer characteristics of nanofluids. Different Thermo-physical properties of nanofluids were also measured and modelled. Associated in design and development of experimental setups, such as for pool boiling, microchannel flow /heat transfer, and electronic chip cooling. Monitored and partially guided many B.Tech and M.Tech students in their project works relating to nanofluids at IIT Madras.

**Lecturer** **2002- 2004**

Worked as Lecturer in Mechanical Engineering, SASTRA Deemed University, Tamil Nadu, India. Apart from teaching, was involved in developing a heat transfer laboratory for undergraduate students as well as setting up research facilities for graduate students.

**Junior Research Fellow** **1999- 2000**

Worked as Junior Research Fellow for Aeronautical Development Agency (ADA Bangalore) in a Project work for L.C.A in Naval Physical and Oceanographic Laboratory (research lab of DRDO, India).

## Research expertise

- 8+ years of research experience with familiarity in the best engineering practices/specifications of codes, and lab safety protocols for mechanical, thermo-fluid testing research, and development.
- Experience in design and scheduling of engineering experiments; acquiring, handling, and processing large-scale datasets, and development of lower-order models and statistical correlations from datasets.
- Research experience in design, procurement and fabrication of pilot-scale lab setup; design, development and troubleshooting of various data acquisition systems, including lasers (CW and pulsed), high-speed cameras (EMCCD/CMOS), microscopes, LabVIEW, and Agilent bench-top equipment.
- Experience in fluid dynamics calculations, including droplets; mixing processes, multi-phase flow, process design, flow conditioning and computational fluid dynamics, and assessment of experimental uncertainty.
- Excellent peoples skill with specific ability to interact with global team member, strong verbal and written communication skills.
- Fluency in using softwares/pakages such as FLUENT, GAMBIT, MATLAB, ENSIGHT, SOLIDWORKS,TECHPLOT.

## Experimental skills

- Developed an experimental setup for micro-droplet impingement visualization studies.
- Developed an experimental setup for measuring near-wall velocities of nanofluids by using an nPIV (nano-Particle Image velocimetry) technique, which utilizes near wall illumination based in Total Internal Reflection Microscopy (TIRF).
- Developed a state-of-the-art steady-state Guarded-Hot Plate apparatus for measuring thermal conductivities of liquids.
- Developed various setups for studying pressure drop, laminar/turbulent convective heat transfer using nanofluids, in mini tubes, electronic chips, laboratory scale heat exchangers, and micro channels.
- Developed various setups for measuring nucleate pool boiling and critical heat flux characteristics while using nanofluids.

## Achievements and awards

- DAAD (German Academic Exchange) Fellowship 2007.
- Best paper award from IARIA, for conference paper in ICQNM 2012.
- Won first prize in 3-D visualization competition VDC11, at TAMUQ.

- *h*-index of 12 for journal publications.

## Professional memberships

- Life Member in Indian Society of Heat and Mass Transfer
- Member, American Physical Society (Division of Fluid Dynamics).
- Member, American Society of Mechanical Engineers (ASME).

## Research Interests

Particle Image Velocimetry, Experimental heat transfer and fluid flow, Computational Fluid Dynamics, Micro-fluidics and Multi-phase flows

## Publications

- 30+ publications in referred journals and conferences
- 1000+ citations from all the publications.

  ResearcherID: E-1279-2016
  Google scholar ID: Anoop Kanjirakat
  Scopus ID: 22833538700

**Book chapter**

1. Sadr R., Kumaran K., Anoop K., and Katsuyoshi T., (2013) "Macro-to-Microscale Thermo-Fluids Research in Energy Efficient Systems", In: *Excellence and Impact of Research at Texas A&M University at Qatar*, Weichold M., Hall K., and Masad E., Eds., QScience, Doha, Chap.6, pp.115-150, ISBN 978-99921-95-33-8.

**Journal Publications**

1. Anoop, K. B., T. Sundararajan and Sarit K. Das, Effect of Particle Size on the Convective Heat Transfer in Nanofluid in the Developing Region, *International Journal of Heat and Mass Transfer*, 52, 2189-2195.2009.
2. Anoop, K. B., S. Kabelac, T. Sundararajan and Sarit K. Das, Rheological and flow characteristics of nanofluids: Influence of electro-viscous effect and particle agglomeration. *Journal of Applied Physics*, 106. 034909. 2009.
3. K. Vijayalakshmi, K.B. Anoop, H. E. Patel, P.V. Harikrishna, T. Sundararajan and Sarit K. Das, Effects of Compressibility and Transition to Turbulence on Flow through Microchannels, *International Journal of Heat and Mass Transfer* , 52, 2196-2204.2009.
4. Prakash Narayan G, Anoop K B and Sarit K Das, Mechanism of enhancement/deterioration of boiling heat transfer using stable nanoparticle suspensions over vertical tubes , *Journal of Applied Physics*, 102 (7), Art. No. 074317 .2007.
5. G. Prakash Narayan, Anoop. K. B, G. Sateesh and Sarit K. Das, Effect of surface orientation interaction on pool boiling heat transfer of nanoparticle suspensions. *International Journal of Multiphase Flow*,. 34(2), pp.145-160. 2008.
6. Sarit K Das , P. G. Narayan and K. B. Anoop , Survey on nucleate pool boiling of nanofluids: the effect of particle size relative to roughness, *Journal of Nanoparticle Research*, 10, 1099-1108.2008.
7. H. E. Patel, K. B. Anoop, T. Sundarajan and S. K. Das, Model for Thermal Conductivity of CNT-Nanofluids, *Bulletin of Materials Science*, v 31, n 3, p 387-390 .2008.
8. Pawan K. Singh, K. B Anoop, H. E. Patel, T. Sundararajan, T.Pradeep, Sarit. K. Das Anomalous Size Dependent Rheological Behavior of Alumina Based Nanofluids *Int. J. of Micro-Nano Scale Transport* 1(2),2010.
9. Pawan K. Singh, K. B. Anoop, T. Sundararajan, Sarit K. Das, Entropy generation due to flow and heat transfer in Nanofluids, *International Journal of Heat and Mass Transfer*, 53, 4757-4767,2010.

10. N. Ozalp , Anoop K, Lagrangian characterization of multi-phase turbulent flow in a solar reactor for particle deposition prediction, *International Journal of Hydrogen Energy*,35, 4496-4509, 2010.
11. N. Ozalp Anoop K, A CFD study on the effect of carbon particle seeding for the improvement of solar reactor performance, *Journal of Heat transfer*,132,122901-7, 2010.
12. R. Sadr, K. Anoop, R Khader, Effects of surface forces and non-uniform out-of-plane illumination on the accuracy of nPIV velocimetry, *Measurement Science and Technology* 23,055303, 2012.
13. K. Anoop, R. Sadr, nPIV measurement of nanofluids in the near-wall region of a Microchannel, *Nanoscale Research Letters*, 7,284, 2012.
14. K Anoop, R. Sadr, J. Yi, S. Kang, S.Jeon and D. Banerjee, Experimental study of forced convective heat transfer on nanofluids in a microchannel, *International Communications in Heat and Mass Transfer* 39, 1325-1330, 2012.
15. Anoop, K. B., J. Cox and R.Sadr, , Thermal evaluation of nanofluids in heat exchangers, *International communications in of Heat and Mass Transfer* 49 ,5-9, 2013.
16. Anoop, K. B., S. Kabelac, and Sarit K. Das, Experimental convective heat transfer studies in a turbulent flow regime using Alumina-water nanofluids. *Qscience Connect*, 39, 2013.
17. K. Anoop, R. Sadr, M. Al-Jubouri and M. Amani, Rheology of nanofluids at high pressure and high temperatures, *International Journal of Thermal Sciences*, 77, 108-115, 2014.
18. Muthusamy, JP. Zhang, T, Alvarado J, Anoop K, Sadr, R;., Effects of High Frequency Droplet Train Impingement on Crown Propagation Dynamics and Heat Transfer, *Journal of Heat Transfer*, 138 (2) pp.020903, 2016
19. Zhang,T, Muthusamy JP, Alvarado JL, Anoop K, Sadr, R, Numerical and experimental investigations of crown propagation dynamics induced by droplet train impingement, *International Journal of Heat and Fluid Flow*, 57, 24-33, 2016.
20. Zhang,T, , Alvarado JL, Muthusamy JP Anoop K, Sadr, R, Effects of High Frequency Droplet Train Impingement on Spreading-Splashing Transition, Film Hydrodynamics and Heat Transfer, *Journal of Heat Transfer*, 138 (2) pp.020902, 2016.
21. Zhang,T, , Alvarado JL, Muthusamy JP Anoop K, Sadr, R, Effects of screen laminates on droplet-induced film hydrodynamics and surface heat transfer, *Journal of Heat Transfer*, 138 (8) pp.080902, 2016.
22. K Anoop, R Sadr,Near-wall thermometry using Brownian motion of PIV particle tracers, *International Journal on Advances in systems and Measurments*,9(1&2),pp:38-47, 2016
23. Anoop K, R. Sadr, Near-wall velocity profile measurement for nanofluids, *AIP Advances* 6(1), 2016.
24. Anoop.K, R.Sadr, R.Yrac,M.Amani, High pressure rheology of alumina-silicone oil nanofluids, *Powder Technology*, 301,pp: 1025-1031,2016.
25. Kumaran K, Anoop K and Sadr R, Effect of nanoparticles on the fuel properties and spray performance of aviation turbine fuel, *J Energy Resources Technology*, 2016 doi:10.1115/1.4034858

**Conference publications**

1. Anoop, K., Taimour, K., Al-Jubouri, M., Sadr R. and Amani, M. ,Viscosity measurements of nanofluids at elevated temperatures and pressures, *ASME, ICNMM 2013, Sapporo, Japan.*
2. Cox, J., Anoop, K., and Sadr, R. Application of nanofluids in a shell-and-tube heat exchanger, *ASME ICNMM2013-73104, Sapporo, Japan.*
3. Anoop, K., and Sadr, R., Heat transfer performance of SiO2-water nanofluid in a plate heat exchanger, *ASME Summer heat Transfer Conference, July 8-12, 2012, Puerto Rico, USA.*

4. Anoop, K., and Sadr, R., Evanescent wave-based near-wall thermometry utilizing Brownian motion, ICQNM 2012*: The Sixth International Conference on Quantum, nano and Micro Technologies, August19-24, 2012, Rome, Italy.*
5. Ozalp, N., K. Anoop. (2010). A CFD study on the effect of carbon particle seeding for the improvement of solar reactor performance. *ASME 4th International Conference on Energy Sustainability (ES2010). Paper No: ES2010-90326.*
6. Pawan K. Singh, Anoop, K. B., Patel, H. E., Sundararajan, T.,Pradeep, T., Sarit. K.Das, Anomalous Size Dependent Rheological Behavior of Alumina Based Nanofluids, *2nd Micro and Nano Flows Conference, West London, UK, 1-2 September 2009.*
7. Kabelac, S., and Anoop, K. B., Experimental Convective Heat Transfer With Nanofluids *ICNMM2008-62099 Proceedings of the Sixth International ASME Conference on Nanochannels, Microchannels and Minichannels ICNMM2008 June 23-25, 2008, Darmstadt, Germany.*
8. Anoop K. B., Patel H. E., Sundararajan T. and Das S. K., "Numerical study of convective laminar heat transfer in nanofluids", *13th International Heat Transfer Conference, Sydney, Australia, 13th – 18th August, 2006.*
9. Anoop, K. B., Patel, H. E., Das, S. K., and Sundararajan, T., Micro- and Nano- Scale Effects in Fluid Mechanics and Heat Transfer, *33rd National and 3rd International Conference on Fluid Mechanics and Fluid Power, IIT Bombay, India, 7th – 9th December, 2006.*
10. Patel, H. E., Anoop, K. B., Sundararajan, T., and Das, S. K., A Micro-Convection Model for Thermal Conductivity of Nanofluids, *13th International Heat Transfer Conference, Sydney, Australia, 13th – 18th August, 2006.*

**Posters and presentations**

1. Anoop Kanjirakat, K. Kannaiyan, R.Sadr, Preparation of aviation fuel based nanoparticle colloids and prospect of its application in pressure atomizers, COLL2013_0555, 6th International Colloids Conference, Germany 19-22, June 2016.
2. Anoop Kanjirakat, Reza Sadr, Rommel Yrac, Mahmood Amani, Pressure cycle rheology of nanofluids at ambient temperature, *68th Annual Meeting of the APS Division of Fluid Dynamics KP1.00107, 60(21), Boston, Massachusetts 2015*.
3. Anoop Kanjirakat, Reza Sadr, Measurement of the near-wall velocity profile for a nanofluid flow inside a microchannel, *68th nnual Meeting of the APS Division of Fluid Dynamics E11.00001, 60(21), Boston, Massachusetts 2015*.
4. Taolue Zhang, Jorge L. Alvarado1, Jayaveera Muthusamy, Anoop Kanjirakat, Reza Sadr, Hydrodynamics and heat transfer of micro-scale surface flows induced by triangulated droplet stream impingement array, *TFESC-12576, Proceedings of the 1st Thermal and Fluid Engineering Summer Conference, TFESC August 9-12, 2015, New York City, USA.*
5. Taolue Z, J. Alvarado, K. Anoop, R. Sadr, experimental characterization and numerical simulation of crown propagation induced by impingement of droplet train, *67th Annual Meeting of American Physical Society-Division of Fluid Dynamics, San Francisco, California, 2014.*
6. Taolue Z, J. Alvarado, K. Anoop, R. Sadr, Hydrodynamics of micro-scale surface flows induced by triangulated droplet stream impingement array, *67th Annual Meeting of American Physical Society-Division of Fluid Dynamics, San Francisco, California, 2014.*
7. Anoop, K., and Sadr, R., Measurement of optical properties of nanofluids and its effects in near-wall flow evaluation, *ICQNM 2013,Spain August 25-31,2013.*

8. Anoop, K., Sadr, R., Rheological assessment of nanofluids at high pressure high temperature, *66th Annual Meeting of American Physical Society-Division of Fluid Dynamics, Pittsburgh, USA, 2013*.
9. Anoop, K., Sadr, R., Optical properties of nanofluids and its implication in nPIV measurements, . *65th Annual Meeting of American Physical Society-Division of Fluid Dynamics, San Diego, USA, 2012*.
10. Anoop, K., Sadr, R., Near-wall velocity measurement of nanofluids using evanescent wave based PIV technique. *64th Annual Meeting of American Physical Society-Division of Fluid Dynamics, Baltimore, USA, 2011*.
11. Kanjirakat, A., Khader, R. and Sadr. R., Evanescent Wave based Near-Wall Thermometry utilizing Brownian Motion, *63th Annual Meeting of American Physical Society-Division of Fluid Dynamics, Long Beach, USA, 2010.*

## Personal details

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| Full Name | : | Anoop Kanjirakat Baby |
| Date of Birth | : | 13th July, 1977 |
| Sex | : | Male |
| Nationality | : | Indian |
| Marital Status | : | Married |

**Anoop**