Jeswin Joseph

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EDUCATION

University of Toronto Institute for Aerospace Studies (UTIAS)   Sep 2021 – Present

Master in Engineering (MEng), Aerospace Engineering   *Present GPA: 3.97 /4.0*

Completed courses: Fundamentals of CFD, Finite Volume Methods in CFD, Introduction to Turbulence, Advanced Fluid Mechanics, Turbulence Modelling, Unsteady Gas Dynamics, Structures in Turbulent Flows, Multiphase Flows, Topics in CFD, Computational Optimization

Indian Institute of Space Science and Technology (IIST)   Aug 2009 – Jun 2013

Bachelor of Technology (BTech), Aerospace Engineering   *CGPA: 7.45 /10*

Courses taken include: Thermodynamics, Heat transfer, Fluid mechanics, Aerodynamics, Atmospheric flight mechanics, Linear algebra, Calculus, Ordinary and Partial differential equations, Space mission design and optimization, Aerospace vehicle design, Solid mechanics and structures, Rocket propulsion.

PROFESSIONAL EXPERIENCE

Aerospace Scientist – Liquid Propulsion Systems Centre (LPSC)   Oct 2013 – Feb 2021

Design of Active Tank Pressure Control for Human Space Program   Jun 2019 – Aug 2020

Developed a system level model of LH2 tank pressurization with active pressure control. Analysed the thermal and flow characteristics of multiple dual-orifice pressurization system during regulated draining mode of the tank. Suggested the best thermal-constrained orifice configuration for tank pressure control.

3D Simulation of Gas-to-Liquid Heat Exchanger for Semi-Cryo Project   Aug 2017 – Jun 2019

Modelled mini-channel heat exchanger with combustion gas and Oxygen fluids using second order upwind pressure-based solver (ANSYS CFX) with SST k-ω turbulence model. Brought out the advantages of operating cold fluid at supercritical pressures so as to avoid large mechanical stress on channel welds.

Development, Testing and Computational Modelling – Cryogenics Lab   Dec 2015 – Dec 2020

Identified as lead scientist for design and development of Cryogenic Tank Test Facility at LPSC. Performed pressurization, draining and external heating trials on LN2 tank and validated thermal stratification model with test data. Developed codes for helium bubble dynamics and mass diffusion through LN2 column.

Design of Hydrogen Feed Circuit Parameters for Re-Entry Mission   Oct 2015 – Jul 2017

Carried out hydrogen flow rate estimation, circuit design and orifice sizing using implicit FDM-based system level modelling and performed its validations with in-house flow trials. Optimized design from the studies was implemented in re-entry mission, which was demonstrated in 2017.

Numerical Coding for Buoyancy-Driven Thermal Stratification   May 2015 – Jun 2017

Developed codes for a comprehensive thermodynamic model of cryogenic liquid enclosed in an insulated tank to estimate the transient evolution of fluid temperature. Cryogenic wall heat transfer, buoyancy-driven fluid motion and consequent thermal stratification in axial direction of tank were considered in the model.

Thermodynamic Ullage Modelling for Mars and Lunar missions   Jul 2014 – Jul 2016

Correlation-based transient two-phase lumped model was developed using SINDA/Fluint solver, considering fluid-wall heat transfer under varying gravity, interfacial heat and mass transfer and deep space

radiation environment. The model was widely used for India's Mars Mission (2014), Indian cryogenic tankages (2016), India's Lunar Mission (2018) and ongoing Human Space Program (HSP) of India.

High Speed Plume Flow Impingement on GSAT-11 Satellite Body   Mar 2014 – Jan 2015

Predicted of high-speed flow shear layer heat transfer rates into satellite solar panels upon interaction with 22N thruster plume undergoing rarefied expansion. Conservation equations along with SST k-ω closure were solved using Least-Squares gradient reconstructed density-based solver in ANSYS Fluent.

Undergrad – Indian Institute of Space Science & Technology (IIST)   Aug 2009 – Jun 2013

Modelling of Film Cooling Injection into Supersonic Free-Stream   Dec 2012 – May 2013

Thesis supervised by Dr. S. R. Shine, IIST. 2-D model to study supersonic coolant injection was developed using second order upwind scheme in ANSYS Fluent. Shock position was validated using literature data. Injection shock structure and coolant efficiency for different coolant injection angles were studied.

Modelling Thermal Environment of a Stratospheric Balloon   Jun 2012 – Jul 2012

Internship supervised by Dr. S. R. Shine, IIST. Developed MATLAB codes for balance of rarefied convection, irradiation and emission over a stratospheric balloon of various diameters. Resultant heat balance equation was solved using Newton's method. Performed parametric study for different surface optical properties.

PUBLICATIONS

Journal Publications

1. Sutheesh P.M, **Jeswin Joseph**, Alex Chollackal, Jophy Peter, Deepak Agarwal: Experimental Investigsation of Thermal Stratification in Cryogenic Tank Subjected to Multi-Species Bubbling. *Journal of Thermal Analysis and Calorimetry (JTAC)*, Springer, 01/2023; DOI: 10.1007/s10973-022-11912-5

2. Gagan Agrawal, **Jeswin Joseph**, Deepak Agarwal, J C Pisharady, S Sunil Kumar: Mathematical Modelling of Thermal Stratification in a Cryogenic Propellant Tank. *IOPScience IOP Conf. Series: Material Sci. Eng.*: 02/2017; 171(1):012045., DOI:10.1088/1757-899X/171/1/012045

3. **Jeswin Joseph**, Gagan Agrawal, Deepak Agarwal, J C Pisharady, S Sunil Kumar: Fluid-hammer induced pressure oscillations in a cryogenic feed line. *IOPScience IOP Conf. Series: Material Sci. Eng.* 02/2017; 171(1):012049., DOI:10.1088/1757-899X/171/1/012049

4. **Jeswin Joseph**, Gagan Agrawal, Deepak Agarwal, J C Pisharady, S Sunil Kumar: Effect of Insulation Thickness on Pressure Evolution and Thermal Stratification in a Cryogenic Tank. *Applied Thermal Engineering* 07/2016; 111., DOI:10.1016/j.applthermaleng.2016.07.015

Conference Proceedings

1. Mebin Cherian, **Jeswin Joseph**, Gagan Agrawal, Deepak Agarwal, T. John Tharakan, Jacob Elias: Effect of regulated draining with non-condensable gas on liquid temperature evolution in a cryogenic tank, *12th International Conference on Thermal Engineering: Theory & Applications* (ICTEA), PDPU Gandhinagar, India, Feb 2019

2. Gagan Agrawal, **Jeswin Joseph**, Deepak Agarwal, J C Pisharady, S Sunil Kumar: Propellant Tank Thermodynamics during Mars Orbiter Mission, *3rd National Conference of Indian Society of Systems for Science and Engg*. (ISSE), Chandigarh, India, 2017

3. **Jeswin Joseph**, Gagan Agrawal, Deepak Agarwal, JC Pisharady, S Sunil Kumar: Chilldown study of Cryogenic Turbopump Bearing coolant cavity. *International Conference on Aerospace and Mechanical Engg*. (ICAME), TKM College, Kollam, India; Dec 2015

4. **Jeswin Joseph**, S.R. Shine: Coolant gas injection on a blunt-nosed re-entry vehicle, *ASME Gas Turbine Conference*, Bangalore, DOI:10.1115/GTINDIA2013-3738, Dec 2013

EXTERNAL PROJECT EXPERIENCE

Design of Thermal System for Oil-based Household Solar Stove   Sep 2017 – Jul 2018

Thermal lead for design, modelling, analysis and realization of solar-heated thermic oil flow system, including parabolic solar reflector sizing, fabrication and 1D thermal and flow simulation of oil feed system. The low-cost system was awarded 4th place and seed funding in ONGC National Chulha Challenge–2017.

SOFTWARE SKILLS

- SINDA-Fluint
- Matlab, Fortran, C++
- ANSYS Fluent, CFX, Workbench
- OpenFoam, Paraview

MEMBERSHIPS OF PROFESSIONAL BODIES

Indian Society of Heat and Mass Transfer (Life Member)

ONLINE CERTIFICATE COURSE

Introduction to Machine Learning (2020)