Tittu Varghese Mathew, PhD

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SUMMARY

PhD, Graduate in Engineering, competent in Computational Mechanics, Uncertainty Quantification and Physics Informed Deep Learning, with strong communication skills, developed from extensive international experience from Europe, India and research collaboration from Australia, Chile and Luxembourg with special expertise in Probabilistic Modeling.

EDUCATION[1]

Indian Institute of Technology Madras   Chennai, India
PhD in Mechanical Engineering   August 2020
THESIS - Advances in Stochastic Finite Element Method for Forward Uncertainty Quantification.
GPA : 8.7/10

Delft University of Technology   Delft, Netherlands
Master of Science in Aerospace Engineering   July 2011
Specialization : Space Systems Engineering & Aerostructures
THESIS - Design of a MEMS micro-resistojet
GPA : 7.7/10

Cochin University of Science and Technology   Cochin, India
BTech (4 year engineering) in Mechanical Engineering   April 2008
GPA : 8/10

PROFESSIONAL EXPERIENCE

Siemens Energy   Oakville, Canada
Probabilistic modelling specialist - Advanced analytics and AI   Sept 2022 – Present
- Developed new methodologies for reliability-based decision making along the product value chain.
- Worked in cross-organizational, multi-disciplinary teams supporting application and implementation of probabilistic modelling, machine learning and optimization.
- Responsible in rolling out probabilistic modelling across the company through knowledge sharing, mentoring and supporting technical trainings.
- Documented the developed methods and processes and presented results to stakeholders.

Bank of America   Toronto, Canada
Software developer   Sept 2021 – August 2022
- Involved in a team that develops front-end applications for ETL purposes using Angular.
- Developed API endpoints for various business needs.
- Implemented kubernetes orchestration using Openshift.

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[1]WES Verified International Academic Qualifications Link

Nobul   Toronto, Canada
Data Scientist   Dec 2020 – June 2021
- Implemented a hybrid ElasticSearch endpoint for retrieving indexed documents based on input user search query and scored them based on customized exponential weighing function. Call to the paid google geocode API gets made only if the ElasticSearch does not return indexed documents, thereby resulting in operational cost savings for Nobul.
- Devised an endpoint for adaptive formatting of containers based on the consumer status on Nobul platform. Verified the functionality of endpoint using Flask API and POSTMAN.
- Experience in working through the complete life-cycle of a machine learning product for customer intent prediction from model development to deployment using Google Cloud Platform.
- Extensive experience in defining tables, writing queries and manipulating SQL databases entirely through Python SQLAlchemy.
- Implemented a machine learning pipeline for natural language processing task of real-estate listings, starting from detailed text pre-processing using python libraries like Scikit-Learn, semantic embedding using BERT/ELMo through visualizing document similarity.
- Instrumental in developing a spectral spatial clustering algorithm on connected graph data of real-estate listings based on both property and geospatial distance features.
- Experience in Agile software development practices.

University of Toronto School of Continuing Studies   Toronto, Canada
Assistant Instructor   Feb 2021 – Aug 2021
- Served as an assistant instructor for a project-based FINTECH bootcamp, where learners were taught popular tools and methods such as Python programming, financial libraries, machine learning algorithms, Ethereum, and blockchain.
- Leveraged machine learning to determine lending preferences and effectivity of customer clustering for interest generation, to model future financial performance of a company using Python and financial fundamentals, to name a few.

Indian Space Research Organisation   VSSC, Trivandrum, India
Mechanical Engineer   Jan – Sept 2014
- Generated 3D part and assembly models for Base Shroud Assembly for Reusable Launch Vehicle (RLV) program and Upper Stub Adaptor assembly for GSLV Launch Vehicles, followed by detailed drawing using Catia V5.
- Established design modification of Wing Leading Edge segments for RLV.
- Automated the digital mockup of C25 castings for semi-cryogenic project using parametric modelling.

Almatech SA   Lausanne, Switzerland
Mechanical Engineer   June 2012 – May 2013
- Prepared cleanliness and contamination budget and control plan for space optical instruments to meet the product quality assurance requirements.
- Interpreted post-test results from vibration and shock tests of space hardware using Excel.
- Worked to develop a dedicated inventory tracking tool (software development) to effectively manage the inventory of space qualified parts.

<div align="center">**RESEARCH EXPERIENCE**</div>

Indian Institute of Technology   Chennai, India
Graduate Researcher   July 2017 – August 2020
- Designed and implemented novel adaptive sampling method for Neural Network based failure prediction of composite plate structures under high-dimensional input parametric space in MATLAB, resulting in 95% computational cost savings.
- Derived, programmed and evaluated the computational efficiency of stochastic inverse subspace model using cell-based smoothed FEM with application on stochastic Functionally Graded Material plate structures using MATLAB.
- Implemented an adaptive deep learning algorithm in TENSORFLOW to solve for Reissner-Mindlin plate structures using Extended Moving Least Squares Method.
- Proposed a novel Physics Informed Deep Learning framework coupled with energy minimization method for characterization of brittle fracture problems in engineering structures, using transfer learning in TENSORFLOW.
- Implemented a Bayesian model selection for damage/inclusion detection in structures using Scaled Boundary Finite Element formulation coupled with Reversible Jump Markov Chain Monte Carlo (RJMCMC) in MATLAB.
- Collaborated with computational scientists from Luxembourg, Chile and Australia for research publications in open literature; mentored 2 graduate and 1 master student.

University of Luxembourg   Belval, Luxembourg
Exchange Researcher   April – July 2019
- Implemented probabilistic parametric estimation on linear continuum Finite Element Models using Markov Chain Monte Carlo sampling in PYTHON PyMC.
- Adapted the algorithm to perform Bayesian inference and model averaging on Gaussian Process surrogates trained on dermatology dataset.
- Peer-reviewed probabilistic journal submissions pertaining to parametric estimation using transitional MCMC.

Indian Institute of Technology   Chennai, India
Research Associate   Jan – June 2017
- Studied and extended strain gradient plasticity formulation for FGM structures using ABAQUS UEL written in FORTRAN.
- Published results in composites journal as first author with research collaboration from UNIVERSITY OF CAMBRIDGE.
- Wrote a research proposal for funding from the Department of Science and Technology (DST), Govt. of India, on phase-field modeling of fracture propagation in FGM structures.

Indian Institute of Technology   Mumbai, India
Research Associate   June 2015 – Sept 2016
- Generated Finite Element model of composite avionic mounting tray using ANSYS Composite PrePost, verified the design against shock loads and presented work to the stakeholders.
- Trained incoming team members to assist with basics of FEM implementation and interpretation of results.

Swiss Space Center, École Polytechnique Fédéral de Lausanne   Lausanne, Switzerland
Research Internship   Oct – Dec 2009
- Assessed feasibility study of colloid thruster for deep space applications.
- Worked with a team of stakeholders from the European Space Agency Micro-Thrust consortium to report on feasibility results.

PUBLICATIONS

- **Tittu V Mathew**, S. Natarajan, Emilio Martínez-Pañeda (2018). "Size effects in elastic-plastic functionally graded materials." *Composite Structures* 204(15):43–51.
- M.L. Kumaraian, J. Rebbagondla, **Tittu Varghese Mathew**, S. Natarajan (2018). "Stochastic Vibration Analysis of Functionally Graded Plates with Material Randomness Using Cell-Based Smoothed Discrete Shear Gap Method." *International Journal of Structural Stability and Dynamics* 19(4) DOI: 10.1142/S0219876219500543.
- **Tittu V. Mathew**, P. Prajith, S. Natarajan, R.O. Ruiz, E. Atroschchenko (2020). "Adaptive Importance Sampling based Neural Network framework for Reliability Prediction and Total Sensitivity Studies of Variable Stiffness Composite Plate with random Geometric Discontinuities and Material Uncertainties." *Composite Structures* 245, 112344.
- **Tittu V. Mathew**, A.L.N. Pramod, Ean Tat Ooi, S. Natarajan (2020). "An efficient forward propagation of multiple random fields using a stochastic Galerkin scaled boundary finite element method." *Computational Methods in Applied Mechanics and Engineering*,367, 112994.
- **Tittu V. Mathew**, Jayamanideep Rebbagondla, S. Natarajan (2020). "An eXtended Stochastic Pseudo-Spectral Galerkin Finite Element Method (XS-PS-GFEM) for elliptic equations with hybrid uncertainties." *International Journal for Numerical Methods in Engineering*, 121 (19), 4329-4346.
- **Tittu Varghese Mathew**, Lars Beex, Stephane P.A. Bordas, Sundararajan Natarajan (2019). "Stochastic Galerkin Cell-based Smoothed Finite Element Method (SGCS-FEM) for random field domains." *International Journal of Computational Methods*, 1950054, 28 pages.
- Shaima M. Dsouza, **Tittu Varghese Mathew**, P. R. Budarapu, S. Natarajan (2020). "A Non-Intrusive Stochastic Isogeometric Analysis of Functionally Graded Plates With Material Uncertainty", Axioms, MDPI (25 pages) DOI:10.3390/axioms9030092.
- Shaima M Dscouza, Hirshikesh Hirshikesh, **Tittu V Mathew**, Indra Vir Singh, S. Natarajan (2020). "A non-intrusive stochastic phase field method for crack propagation in functionally graded materials", *Acta Mechanica*,1-20.
- **Tittu Varghese Mathew**, B.T.C. Zandbergen, Marco Mihailovic, J.F. Creemer, P.M. Sarro (2011). "A silicon based MEMS resistojet for propelling cubesats." *62nd International Astronautical Congress*, IAC -11.C4.3.2.
- M. Mihailovic, **T. V. Mathew**, J. F. Creemer, B. T. C. Zandbergen and P. M. Sarro (2011). "MEMS silicon-based resistojet micro-thruster for attitude control of nano-satellites" *16th International Solid-State Sensors, Actuators and Microsystems Conference, Beijing*, pp. 262-265, doi: 10.1109/TRANSDUCERS.2011.5969432.

SKILLS

Languages:	English (Fluent), French (B1 proficiency), German (A1 proficiency)
Computer:	Proficient in programming in PYTHON, MATLAB, C++, FORTRAN
Software:	Finite Element Modeling in ABAQUS, 3D modelling in CATIA V5, GEANT4 for particle-matter interaction physics.
Certifications:	MSC NASTRAN PATRAN (Linear static and Non-linear)
	Bayesian methods for Machine Learning, Coursera 2020
	Bayesian Statistics : From Concept to Data Analysis, Coursera 2017
	Sensor fusion and Non-linear filtering for Automotive systems, edX 2020
	Stochastic Modelling : Data analysis and computer simulations, edX 2017
	Python for High Performance Computing, PRACE 2020
	Introduction to Computational Material Design, Osaka, edX, 2021
	Boltzmann Law : Physics to Computing, Purdue, edX, 2021.