Dinesh Kumar

RESEARCH INTERESTS
Machine learning, Inverse Problems, Data Assimilation.
CFD, Mathematical Modeling, Numerical Analysis
Uncertainty Quantification, Robust Optimization.

EDUCATION

Vrije Universiteit Brussel, BELGIUM

Ph.D (with **greatest distinction**), Dept. Mechanical Engineering, Jan. 2017.
- Dissertation Topic: "Development of efficient uncertainty quantification and robust optimization methods for advanced applications in computational fluid dynamics"
- Advisor: Em. Prof. dr. ir. Chris Lacor

Jawaharlal Nehru Center for Advanced Scientific Research, Bangalore, INDIA

MS-Engg by Research, Engineering Mechanics Unit.

Indian Institute of Technology Kanpur (IITK), INDIA

Bachelor of Technology, Aerospace Engineering.

RESEARCH EXPERIENCE

Luxembourg Institute of Science and Technology, LUXEMBOURG   **April, 2019 - Dec. 2020**
- EU Horizon 2020 project COMPOSELECTOR.
- Uncertainty quantification and robust optimization in composite materials.

CEA Cadarache, FRANCE and **Uppsala University**, SWEDEN   **May, 2017 - April 2019**
- A joint collaborative project funded by the Swedish Research Council.
- Uncertainty quantification and nuclear data assimilation using Bayesian inference and transposition of uncertainties to GEN-IV concept reactor ASTRID.

EDF Chatou, FRANCE   **Feb 2017 - April 2017**
- Shape optimization in hydraulics applications: Optimal shape design of water intakes on a simplified configuration of the Paluel power plant.

Vrije Universiteit Brussel, BELGIUM   **Oct, 2011 - Jan 2017**
- EU's 7th FP project UMRIDA.
- Development of efficient uncertainty quantification and robust optimization methods for advanced applications in CFD.

Yonsei University, Seoul, S. KOREA   **March, 2010 - Dec 2010**
- Understanding the physics behind heat transfer enhancement in nano-fluid with turbulent conditions by 3D DNS turbulence modeling.

Jawaharlal Nehru Center for Advanced Scientific Research, Bangalore, INDIA   **Aug, 2007 - Feb 2010**
- Numerical Simulation & Experimental Investigation of Fluid Instabilities (MS Thesis).

Indian Institute of Technology Kanpur (IITK), INDIA
- Supersonic nozzle design and high speed wind tunnel experiments.
- Design, fabrication and wind tunnel experiment on flapping wing model with twisting and spanning mechanics. (B.Tech project)

BOOK CHAPTERS   Uncertainty Quantification and Robust Optimization in Engineering, Kumar et al., Advances in Visualization and Optimization Techniques for Multidisciplinary Research. Lecture Notes in Mechanical Engineering, Springer, 2020.

Non-intrusive Uncertainty Quantification by Combination of Reduced Basis Method and Regression-based Polynomial Chaos Expansion, M. Raisee, D. Kumar and C. Lacor: Findings and Best Practice Collected During UMRIDA, a Collaborative Research Project (Funded by the European Union), Springer, 2019.

Combination of Polynomial Chaos with Adjoint Formulations for Optimization Under Uncertainties, D. Kumar, M. Raisee and C. Lacor: Findings and Best Practice Collected During UMRIDA, a Collaborative Research Project (Funded by the European Union), Springer, 2019.

PUBLICATIONS   Kumar D et al., Quantitative risk assessment of a high power density small modular reactor (SMR) core using uncertainty and sensitivity analyses (under review).

Kumar D et al., Efficient uncertainty quantification and management in the early stage design of composite applications, Composite Structures, 2020 (https://doi.org/10.1016/j.compstruct.2020.112538).

Kumar D et al., Nuclear data adjustment using Bayesian inference, diagnostics for model fit and influence, EPJ Web Conf., 239 (2020) 13003 (doi.org/10.1051/epjconf/202023913003).

Alam S, Almutairi B, Ridwan T, Kumar D et al., Neutronic investigation of alternative & composite burnable poisons for the proposed soluble-boron-free and long life civil SMR cores, Scientific Reports (Sci Rep 9, 19591 (2019) doi:10.1038/s41598-019-55823-2).

Alam S, Kumar D et al., Lattice Benchmarking of Deterministic, Monte Carlo and Hybrid Monte Carlo Reactor Physics Codes For the Soluble-Boron-Free SMR Cores, Nuclear Engineering and Design, Elsevier (accepted: https://doi.org/10.1016/j.nucengdes.2019.110350).

Alam S, Kumar D et al., Small modular reactor core design for civil marine propulsion using micro-heterogeneous duplex fuel. Part I: Assembly-level analysis, Nuclear Engineering and Design, Elsevier, Vol. 346, pp. 157-175, 2019.

Alam B, Ridwan T, Kumar D et al., SMR core Design for Civil Nuclear Marine Propulsion Using Micro-Heterogeneous Duplex Fuel. Part II: Whole-Core Analysis, Nuclear Engineering and Design, Elsevier, Vol. 346, pp. 176-191, 2019.

Alam S, Almutairi B, Kumar D et al., Neutronic feasibility of civil marine small modular reactor core using mixed D2O+H2O coolant, Nuclear Engineering and Design, Elsevier (accepted: https://doi.org/10.1016/j.nucengdes.2019.110449).

D. Kumar, S. Alam, H. Sjstrand, J. M. Palau, C. De Saint Jean, Influence of nuclear data parameters on integral experiment assimilation using Cooks distance, EPJ Web Conf. 211-07001 (2019).

D. Kumar, B. Almutairi, S. Alam and C. S. Goodwin, 3D SPN Transport and Diffusion Approaches for the Sodium-Cooled Fast Reactor Core Using Deterministic Method, Transaction of the American Nuclear Society, Vol 120, pp. 883-886, July 2019.

S. Alam, B. Almutairi, D. Kumar and C. S. Goodwin, Uncertainty Quantification on Core Input Parameter for SFR Core Using Polynomial Chaos, Transaction of the American Nuclear Society, Vol 120, pp. 1-12, July 2019.

S. Alam, B. Almutairi, D. Kumar and C. S. Goodwin, Uncertainty Quantification of SMR Core

Linear Power Using Polynomial Chaos Method, Transaction of the American Nuclear Society, Vol 120, pp. 871-874, July 2019.

B. Almutairi, S. Alam, D. Kumar and C. S. Goodwin, Reactor Physics Analysis of Thorium-Based Fuel for Long-Life SMR Cores, Transaction of the American Nuclear Society, Vol 120, pp. 875-878, July 2019.

S. Alam, B. Almutatiri, T. Feng, D. Kumar et al., Computational Modeling of Doppler Coefficient for 3D AGR Pin Cell using the Coupling of Deterministic Method & Matlab, Int. Congress on Advances in Nuclear Power Plants (ICAPP), France, 2019.

S. Alam, B. Almutairi, D. Kumar, C. S. Goodwin, 3D Modeling of Reduced-Moderation Water Reactor Lattice for P0 and P1 scattering approximation using deterministic and Monte Carlo codes, proceeding of Pacific Basin Nuclear Conference - 2018.

S. Alam, B. Almutairi, D. Kumar et al., Convergence studied using method of characteristics solver for the reduced moderation water reactor model, proceeding of Pacific Basin Nuclear Conference - 2018.

D. Kumar, M. Raisee and C. Lacor, An Efficient Non-intrusive Reduced Basis Model for High Dimensional Stochastic Problems in CFD, Computers & Fluids, Vol. 138, pp. 67-82, 2016.

D. Kumar, J. Miranda, M. Raisee, C. Lacor, Adjoint based multi-objective shape optimization of a transonic airfoil under uncertainties, Proceedings of the 5th International Conference on Engineering Optimization, Iguassu Falls, Brazil, June 2016.

J. Miranda, D. Kumar, C. Lacor, Adjoint-based robust optimization using polynomial chaos expansions, Proceedings of the Eccomas congress, Crete Island, Greece, June 2016.

M. Raisee, D. Kumar and Chris Lacor, A Nonintrusive Model Reduction Approach for Polynomial Chaos Expansion Using Proper Orthogonal Decomposition, Int. J. Numer. Meth. in Engng (IJNME), Vol 103, Issue 4, pp. 293-312, 2015.

A. Bonanni, T. Banyai, M. Raisee, D. Kumar, J. VanBeeck, H .Deconinck, C. Lacor, Wind Farm Optimization based on CFD Simulation of Non-Flat Terrain, International Scientific Journal, Journal of Environmental Science, Vol 4, Issue 1, pp. 51-56, 2015.

D. Kumar, M. Raisee and C. Lacor, An Efficient Non-intrusive Reduced Basis Approach for Uncertainty Quantification in CFD, Proceedings of the 1st ECCOMAS Thematic Conference on International Conference on Uncertainty Quantification in Computational Sciences and Engineering, 2015.

M. Raisee, D. Kumar and Chris Lacor, Stochastic Model Reduction for Polynomial Chaos Expansion Using Proper Orthogonal Decomposition, Chaotic Modeling and Simulation, vol.4, pp.615 623, 2013.

D. Kumar and C. Lacor, Heat conduction in a 2D domain with geometrical uncertainty using intrusive polynomial chaos method, Proceedings of the 9th National Congress on Theoretical and Applied Mechanics, May 9-10, 2012, Brussels (Belgium) - ISBN 978-2-8052-0151-6.

CONFERENCE AND DISSEMINATION ACTIVITIES	FJOH Summer School on Nuclear Reactors Physics, Fuels, and Systems, Karlsruhe, Germany, Aug 23 - Sep 1, 2017
	Efficient uncertainty quantification in computational fluid dynamics using polynomial chaos approach, Sixth International Conference on Turbulent Mixing and Beyond, Abdus Salam International

Centre for Theoretical Physics, Trieste, Italy, 14-18th August, 2017.

School on Uncertainty Quantification for Hyperbolic Equations and Related Topics, Gran Sasso Science Institute School of advanced studies, L'Aquila, Italy, April 24-28, 2017.

Young European Statisticians (YES VIII) Workshop on Uncertainty Quantification, Eindhoven, January 23-25, 2017.

Aerodynamic shape optimization of the RAE2822 airfoil under uncertainties using adjoint based multi-objective approach, Dinesh Kumar, M. Raisee and C. Lacor, 2nd UMRIDA UQ and RDO Symposium & Workshop, VUB Brussels, Belgium, 20-22 Sep, 2016.

Efficient Uncertainty Quantification of the Falcon Jet using Polynomial Chaos based Reduced basis Model, M. Raisee, Dinesh Kumar and C. Lacor, 2nd UMRIDA UQ and RDO Symposium & Workshop, VUB Brussels, Belgium, 20-22 Sep, 2016.

5th UMRIDA Progress Meeting, EPFL, Lausanne, Switzerland, April 4th-6th, 2016.

4th UMRIDA Progress Meeting, CIMNE, Barcelona, Spain, October 5th-6th, 2015.

An efficient non-intrusive PC-based reduced order scheme for uncertainty quantification of high dimensional stochastic problems, Dinesh Kumar, Mehdrad Raise & Chris Lacor, UMRIDA Workshop on Uncertainty Quantification, TU Delft, Netherlands, 15-16 April 2015.

3rd UMRIDA Progress Meeting, TU Delft, Netherlands, 13th-14th April 2015.

Efficient Uncertainty Quantification Schemes for Handling Large Number of Uncertainties Recent Development and Applications, M Raisee, Dinesh Kumar and Chris Lacor, Francis99- workshop 1, Norwegian University of Science and Technology, Trondheim, Norway, December 2014.

A Reduced Basis Approach for Efficient Nonintrusive Polynomial Chaos in CFD, Dinesh Kumar, Mehdrad Raise & Chris Lacor, 7th Dresdner-Probabilistik-Workshop, Dresden, Germany, October 2014.

Second UMRIDA Progress Meeting, TU Dresden, Germany, October 6th -7th 2014.

Towards an efficient non-intrusive polynomial chaos approach for high dimensional stochastic problems using a reduced basis approach , Dinesh Kumar, M Raisee and Chris Lacor, ECCOMAS European CFD Conference, Barcelona, 20-25 July 2014.

Participated in Aerovehicles 1, First international conference in numerical and experimental aerodynamics of road vehicles and trains, 23-25 June 2014, Bordeaux, France.

Development of a Non-Intrusive Model Reduction Approach for Polynomial Chaos Representation , M Raisee, Dinesh Kumar and Chris Lacor, International Workshop on Uncertainty Quantification in Fluids Simulation, BOQUSE 2013, Bordeaux, 16-18 December 2013.

Participated in 2nd International Workshop on Reduced Basis, POD and PGD model : An ECCOMAS thematic conference in computational methods in applied sciences, 3-6 November 2013, Blois, Centre France.

Uncertainty quantification in computational fluid dynamics, poster presentation, Summer School on Computational Aspects of Uncertainty Quantification, May 27-31, 2013, Leuven, Belgium.

Workshop: Numerical Methods for Uncertainty Quantification : 13-17 May 2013, Bonn, Germany.

Efficient uncertainty quantification with polynomial chaos, oral presentation, Dinesh Kumar, Mehdrad Raise & Chris Lacor, at Ercoftac-Belgium yearly seminar on Dec 7, 2012, UCL Belgium.

Uncertainty quantification using intrusive polynomial chaos methods in computational fluid dynamics, Dinesh Kumar & Chris Lacor, NSE-PhD day VUB Belgium, 8th June 2012.

Participated in Advanced school on scaling laws in geophysics, ICTP, Italy, May 2011.

Participated in International workshop on CFD & Computational methods, South Korea, September 2010.

Simulation and experimental observation of RT instability and Salt-diapirs, D. Kumar & K. R. Srinivas poster presentation at High Rayleigh Number Convection workshop, Les Houches, France, January 2010.

Numerical simulation and experimental investigation of salt-diapirs, D. Kumar & K. R. Srinivas, poster presentation at EPFDC09 University of Nottingham, UK, July 2009.

SCHOLASTIC ACHIEVEMENTS

- Reviewer, Mathematical Problems in Engineering, Hindawi.
- Reviewer, Nuclear Engineering and Design, Elsevier.
- Reviewer, Annals of Nuclear Energy, Elsevier.
- Reviewer, Progress in Nuclear Energy, Elsevier.
- Certificate for outstanding contribution in reviewing, from the editors of Annals of Nuclear Energy, May, 2018.
- Awarded full funding from Argonne National Lab to participate MEV (Modelling, Experimentation and Validation) school organized by ANL, INL, ISU, ORNL in Argonne, USA, July 2018.
- Awarded full funding from GSSI, L'Aquila, Italy to attend school on Uncertainty Quantification for Hyperbolic Equations and Related Topics, 2017.
- Co-chaired a mini-symposium sesion Non-determinstic Simulation in CFD 1 at ECCOMAS European CFD Conference, Barcelona, 20-25 July 2014.
- 2nd best poster in the conference EPFDC09, University of Nottingham, UK, July 2009.
- GATE Scholarship holder for MS-Engg from Indian government.
- Awarded travel support from DST, India to attend workshop High Rayleigh Number Convection, Lyon, France, Jan 2010.
- Awarded full support from ICTP to participate Advanced school on scaling laws in geophysics, ICTP, Italy, May 2011.
- One of the best B Tech projects of Aerospace Department 2006 batch.