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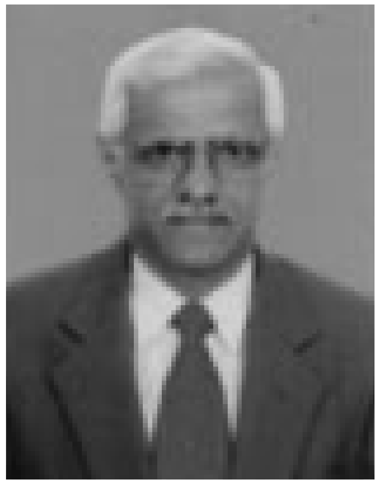


Dr. A R Upadhya

Former Director, CSIR-National Aerospace Laboratories, Bangalore
Former Dr Raja Ramanna DRDO Distinguished Fellow
Currently Distinguished Professor, Internatioanl Institute of Aerospace Engineering & Management, Jain University, Bangalore

Profile: Dr A R Upadhya holds B Tech and M E degrees in Aeronautical Engineering from IIT, Kharagpur and Indian Institute of Science respectively, and a Ph D from Cranfield Institute of Technology, UK . He served as a Scientist at the CSIR – National Aerospace Laboratories initially during 1974-1986 and then at the Aeronautical Development Agency, Ministry of Defence(MoD) during 1986-2004 on the Light Combat Aircraft programme in the areas of Loads, Dynamics and Aero-Servo- Elasticity. He returned to CSIR-NAL as its Director in 2004 and served the Laboratories till his superannuation 2011. Subsequently, Dr Upadhya was appointed as Dr Raja Ramanna DRDO Distinguished Fellow of the Department of Defence Research, MOD at ADA for a period of 4 years. Dr Upadhya has 10 journal papers, and over 150 presentations in international/national conferences, meetings, workshops etc . He has edited Proceedings of three international and national conferences and also has a chapter(with a co-author) on wind and tidal energy in an INSA book on Sustainable Energy to his credit. Presently he is a Distinguished Professor at Jain University, Vice Chairman of NALTECH and Convener of INAE's Sectional Committee on Aerospace Engineering.

Dr Upadhya was also closely associated with the country's novel National Programmes on Smart Materials & MEMS, first as the Programme Director of the first programme NPSM and later as Co-chairman of the Executive Committee of the Second programme NP-MASS. Dr Upadhya was also associated with the Aeronautical Research and Development Board, a national body for aeronautical research under DRDO, first as the Coordinator of its Structures Panel and later as the Convener of its Technical Committee.

Dr Upadhya's contributions have been recognised with the Distinguished Alumnus Award of IIT- Kharagpur and of the Department of Aerospace Engineering, Indian Institute of Science, Visvesvaraya Vijnana Puraskar of Swadeshi Vijnana Andolana in 2008, "Engineering Personality" honour by the IE(India) in 2009, Election as Corresponding Member, Section 4 (Social Sciences) of the International Academy of Astronautics in 2007 and as a Honorary Member of ISAMPE in 2010, Presentation of Citation by IE(India)-M&ME Division in 2008, IE(India), Rajasthan State Centre in 2010 and the Institute of Smart Structures and Systems(ISSS) in 2012. He is a Fellow of the Indian National Academy of Engineering (INAE) and Aeronautical Society of India. He had also served as President of ISSS and ISAMPE and is a Life Member, Society for Aerospace Quality and Reliability.

Title: Structural Optimisation in the Aircraft Industry

Abstract: The basic principles of and approach to structural optimization is briefly described. The tools used in the aircraft industry with their attributes are listed. The airframe design process starting with the structural layout, material selection, CAD model , structural finite element model, loads model etc., leading to definition of maneuver loads and initial sizing is described. The process of optimization of CFC wing skins for minimum weight involving selection of critical load cases, definition of design variables and optimization constraints, the method used etc are discussed. Typical results including convergence history, evolution of optimum weight, constraint influence zones, optimum design and its conversion to a practical wing skin design are presented.

Dr. Arun K. Misra

Thomas Workman Professor
Department of Mechanical Engineering
McGill University, Montreal, Canada

Interest Area: Removal of Space Debris

Profile: Dr.Arun K. Misra is currently the Thomas Workman Professor in the Department of Mechanical Engineering at McGill University in Montreal, Canada. He received his B.Tech. (Honours) degree from IIT, Kharagpur and Ph.D. from the University of British Columbia, Vancouver, Canada. He has been a faculty member at McGill University since 1978. He has served as the Chair of the Department of Mechanical Engineering at McGill University for 11 years and as the Associate Dean (Academic) of the Faculty of Engineering for 4 years.Dr.Misra conducts research in various areas such as spacecraft attitude dynamics and control, orbital mechanics, space debris, space robotics, tethered satellites and fluid-structure interaction. He has authored approximately 120 journal papers and 130 conference papers. He is a Co-Editor of the journal ActaAstronautica and is on the Editorial Board of the Journal of Aerospace Engineering – Proceedings of the Institution of Mechanical Engineers, Part G.Dr.Misra is a Fellow of the American Institute of Aeronautics and Astronautics (AIAA) as well as of the American Astronautical Society (AAS). He has been elected to the Canadian Academy of Engineering and to the International Academy of Astronautics (Full Member).

Abstract: Since the beginning of the space era in 1957, there has been a steady growth in the number of objects orbiting the Earth. These include operational and dead satellites, fragments of satellites, spent launch vehicle upper stages, and other mission-related items. This “space debris” is located mainly in the low Earth orbits (LEO), but there are also a significant number of objects in the geostationary (GEO)orbits. Hence space debris has become one of the major challenges for future space operations, in particular in LEO. This has led to the development of many potential debris removal methods, both passive and active. One of the methods expected to be used for debris removal involves capturing the debris with a space manipulator mounted on a service spacecraft. The operation consists of three phases: pre-capture, capture and post-capture. Each of these phases poses its own challenges. Motion of the links of the manipulator during capture will lead to the attitude drift of the service spacecraft. Another possible method to capture space debris involves the use of a tether-net. Study of the deployment dynamics and capture dynamics of tether-nets is an evolving field. After the space debris has been captured with the help of a tether-net or a harpoon, it has to be moved to a graveyard orbit. This can be accomplished by towing the debris using a space tug and a tether. A low thrust must be applied to the space tug to maintain tension in the tether as well as to carry out low thrust orbital transfer. The paper presents a mathematical model of the tug-tether-debris system to investigate the vibrational dynamics of the tether as well as the orbital motion of the tug.

Dr. Kali Charan Nayak

Aviation & Aerospace
Rolls-Royce
Bangalore, India

Interest Area: SpecialistThermo-fluid System

Profile: Kali CharanNayak has received his masters and PhD in Mechanical engineering from Indian Institute of Science, Bangalore. He is presently working for Rolls-Royce India Private Limited, Aerospace Engineering as a specialist in fluid and thermal systems design. Prior to joining Rolls-Royce, he has spent about twelve years with GE Aviation, Bangalore in various roles with increasing responsibility. He was a technical leader, engineering manager and control title holder during his tenure in GE, Aviation. He significantly contributed to thermal and fluid systems design and development of modern aircraft engines in GE and Rolls-Royce such as LEAP-1A/1B, PP20 and Trent-XWB. For his academic and technical excellence he received many awards and rewards in academia and industry. He has published several papers in ASME Journal of Gas Turbine and power, Journal of Tribology and servers as a reviewer in Tribology Transactions and Journal of Thermo-physics. He also chaired Heat Transfer sessions in ASME Gas Turbine India Conference. His research interests include heat transfer and fluid dynamics in secondary cavities, air system design, CFD and Turbulence, fluid-structure interaction, Seals, Vortex Dynamics.

Dr. Changduk Kong

Department of Aerospace Engineering
Chosun University
South Korea

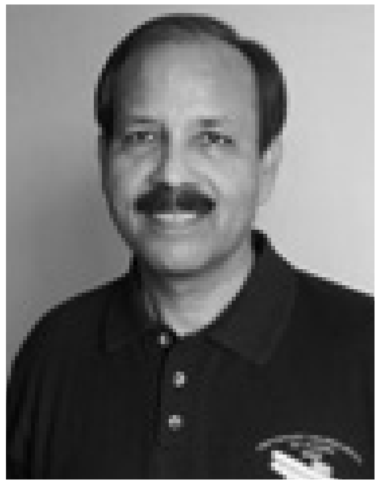
Interest Area: Structural Optimization of an Automobile Hood Using Natural Flax Fiber Reinforced Plastic Composites and RIM Manufacturing Method

Profile: Prof. Kong graduated with a BSc in Aerospace Engineering from the Korea Aerospace University and a PhD in Aerospace Engineering from the Osaka Prefecture University, Japan. He was appointed to Professor in 1994 in the Department of Aerospace Engineering at Chosun University and was Dean of the School of Aerospace and Naval Architecture Engineering in 1999/2005-2006 and Dean of the Facility Management Office at Chosun University, 2011-2012.Prof. Kong has contributed greatly to the development of Aerospace Engineering in Korea, primarily through his roles as President of SASE (The Society for Aerospace System Engineering) in 2013-2014, President of ICRC (International Collaboration Research Centre in Natural Composites, Chosun University) since 2012, former President of KSAS (The Korean Society for Aeronautical and Space Sciences, 2012), former President of KSPE (The Korean Society of Propulsion Engineers, 2007-2008), Ex-Chair of Cycle Innovation-IGTI-ASME between 2009 and 2011, former President of RIME (Research Institute of Mechanical Engineering-Chosun University, 2006-2008) and former Head of the Aero-Propulsion Division of ADD (Agency for Defence Development,1978-1994), First Lieutenant of ROKAF(Republic of Korea Air Forces, 1974-1978). He was Visiting Professor at Imperial College London (2011-2012) and is on the Editorial Board of IJTJ, IJCM, AEAT (2001-present), and Editor-in-Chief of JKSAS and JKSPE(2006-2010). He received the Korean National Decoration in Science for his scientific achievement and contribution to Korean aerospace development, and Academic Achievement Awards from KSAS and KSPE.Prof. Kong has authored and co-authored more than 600 papers including 61 SCI journal papers, and has received numerous lecture invitations from companies, research institutes and universities and delivered six keynotes and invited lectures at international conferences. He has organized 19 national conferences, forums and workshops and was co-organiser on three international conferences.

Abstract: Recently due to increasing interest in eco-friendly materials, studies on fiber obtained from nature have been actively performed to the area of composite. Although the natural flax fiber has less strength than the high strength fiber such as the carbon fiber, it has similar strength to glass fiber. Natural fibers have some advantages such as cost effective, recycling and low energy consumption due to obtainable from nature rather than manmade fibers by using high energy consumption. Accordingly, it can be applied as very advantageous composite when an appropriate resin has been selected. In this study, the design of eco-friendly structure using flax fiber was performed after investigation on mechanical properties of natural composite. The selected target structure is a hood of a small compact automobile. This work is to perform an optimal design of a small compact automobile hood structure using eco-friendly flax/vinyl ester natural fiber composite to meet automobile company's design requirements including strength and stiffness and HIC (Head Injury Criterion) requirements, and to manufacture properly the designed hood using RIM (Resin Infusion Molding) through resin flow simulation.

An optimal design of a small compact automobile hood structure using eco-friendly flax/vinyl ester natural fiber composite to meet automobile company's design requirements including strength and stiffness and HIC (Head Injury Criterion) requirements has been carried out. Topology and size structural design optimization of inner panel and skin of a car hood using commercial FE code 'ANSYS shape optimization. Mechanical properties of Eco-friendly biaxial flax fabric/vinyl-ester composites specimens manufactured by RIM were investigated by ASTM standards, and design and analysis of hood structure were performed using the flax composites. The proposed design results met well the design requirements including all load cases, and structural safety was confirmed. Pedestrian's safety based on HIC was confirmed by impact analysis and the interface requirement due to impact was investigated. RIM's manufacturing conditions were found through resin flow simulation and properly manufactured. Resin flow analysis was performed using code 'Polyworx'.

Prototype hood was manufactured using the proposed RIM manufacturing process; the tested resin infusion time was compared with analysis result. Structural test was performed to confirm the designed result, the measured strain and deflection were well agreed with analysis result.



Dr. S. D. Sharma

Professor
Department of Aerospace Engineering
IIT Bombay

Research Interest: Separated flow control, vortex flows, turbulent mixing, aero-thermo-acoustics, high speed jet acoustics, cardio-vascular flows, experimental techniques

Profile: Professor Sharma obtained his degrees of B.E. in Mechanical Engineering from Sardar Patel University, Gujarat in 1977; M.Tech. and Ph.D. in Aerodynamics from IIT Bombay in 1979 and 1988, respectively. Post his Ph.D. work in the field of Aerodynamics at IIT Bombay, he joined Indian Institute of Science, Bangalore in April 1982 and got involved in research in the diversified field of cavitation and underwater noise in the high speed water tunnel, the only facility of its kind in the country. The research involved extensive measurements of cavitation noise from an indigenously designed marine propeller operating in both free flow and simulated ship wake flow, and self-noise of underwater slender bodies. A single srew ship wake was physically simulated and measured for the first time in the research field. On resuming research in the field of Aerodynamics at IIT Bombay, he designed and indigenously set up number of wind tunnels of different types for national defence and industrial projects, and carried out experiments on a variety of problems using flow visualization, hot wire and LDV techniques. In the recent past, he has set up three research laboratories: Cardio-Vascular Flow Dynamic Lab, a large Anechoic Chamber for high speed jet noise studies, and Thermo-Acoustic Lab. So far 9 Research Scholars have obtained their Ph.D. degrees under his supervision and 5 more are underway. He has more than 70 papers to his credit in peer reviewed journals and conferences.

He has been the department Head (2011-14), Member of Aerodynamics and Resources Panels of AR&DB (2011-17), reviewer for international journals, and Editor-in-Chief for International Journal of Emerging Multidisciplinary Fluid Sciences (2009-14). He is consultant to industries for flow related problems.

Abstract: Interaction between two shear layers separating from a nominally two-dimensional bluff body and possessing vorticity of opposite sense is known to govern the dynamics of near wake. The resultant unsteady wake is dominated by the alternate vortex shedding causing high form drag and flow induced vibration. A variety of control techniques to mitigate these adverse effects has been reported in literature.

In the present work, two different active and passive techniques have been innovated to control the near wake dynamics by cancelling vorticity of only one of the shear layers. The active technique involves tangential injection of thin sheet of high momentum flow at the trailing edge just before the separation. The momentum injection is applied in two ways – steady and pulsatile. The technique is particularly effective in suppressing the vortex-shedding when the blowing is with moderate mass flow rate and the forcing frequency is twice the natural vortex-shedding frequency. As a consequence of intermittent injection of momentum there is a significant saving in mass flow required to achieve a condition of the momentum less wake. In spite of the initial conditions being strongly asymmetric, the flow pattern in the wake is observed to quickly assume a remarkable symmetry.

The passive control technique uses a short plate placed behind a circular cylinder in one of the shear layers. An incidence angle of the plate is introduced as one of the control parameters beside its longitudinal and transverse positions. The incidence angle of the plate is chosen such that it generates circulation of opposite sign compared to the sign of vorticity of the shear layer. Increase in the incidence angle results in elongation of the vortex formation region. The transverse position of the plate determines whether the lower speed (inner) edge or the higher speed (outer) edge of the shear layer will graze over the plate. The former case enhances the vorticity of the shear layer and does not suppress the vortex shedding. Whereas the latter is found to completely suppress the vortex shedding with much larger extension of the mean closed bubble which contains a complex system of contra rotating multiple vortices. In both cases turbulence kinetic energy is diminished thereby reducing the form drag.

Dr. Sunder Gupta

Retired Scientist/ Executive
NCR Corporation, Rockwell International, Northrop Corporation and Boeing, USA

Research Interest: Global Positioning System

Profile: Dr. Surender Gupta graduated from IIT Kharagpur in Aeronautical Engineering's first batch of 1967. The same year he came to the United States to pursue his Master's in Aerospace Engineering under a Research Assistantship at the Pennsylvania State University. Subsequently, he received another Master's and a PhD degree in Control Systems and Systems Engineering from the Washington University in St. Louis. He also has a third Master's degree in Management. He has worked at top organizations in the US including NCR Corporation, Rockwell International, Northrop Corporation, and Boeing Company. His favourite program has been the development of various aspects of the GPS system. He was also an Associate Professor in the School of Electrical and Electronic Engineering at the Nanyang Technological University in Singapore from 1992 to 1998. He has been active in philanthropy. He is the founder trustee of "Gupta Foundation", a tax exempt charitable organization in the USA. Gupta Foundation sponsored and completed the development of a Dharamshala including a temple in Karnal, Haryana, his childhood hometown. He is married to Srimati Hemlata and has two sons, Garun and Punj, who all live in the USA. Kavi and Kanu are his two grandsons.

Abstract: GPS or Global Positioning System started in 1960's at the dawn of space age as a system to improve the navigation performance of military operations with stipulated positioning accuracy of 10 meters. As its development progressed and its accuracy and utility continuously enhanced beyond theoretical expectations, its use expanded to all walks of human life. Currently, it has become a common global utility. The system accuracy continues to get better and is expected to be the operational work horse of futuristic pilotless vehicles. This presentation will aim to walk you through its development journey during the past 60 years and point to some things in the years to come

Dr. T K Ghoshal

Emeritus Professor
Department of Electrical Engineering
Jadavpur University, Kolkata

Profile: Dr Tapan Kumar Ghoshal is currently an Honorary Emeritus Professor at the Electrical Engineering Department of Jadavpur University, where he had been a faculty since 1967. He served as a Coordinator for the Centre for Knowledge Based System and as a Joint Director, School of Education Technology, Jadavpur University for 16 years. After completing his graduation (1966) and post-graduation (1969) in Electrical Engineering from Jadavpur University, he obtained his Ph.D in Flight Control from Cranfield Institute of Technology, U.K (1976). He is a Fellow of National Academy of Engineers, Astronautical Society of India, West Bengal Academy of Science and Technology and a member of the System Society of India. Professor T K Ghoshal is widely known for his contribution towards Indian aerospace research and development. He took leading roles in the development of Flight Control and Guidance systems for Nag and Prithvi missiles. He had been the Leader of the Independent Verification and Validation team for India. Light Combat Aircraft. His other contributions have benefited the ASLV and PSLV launch vehicles of ISRO, Agni, Akash, Trishul and Dhanush missile systems of DRDO, Railway signaling automation and number of industrial systems. He had acted as an advisor to the India Science Laboratory of General Motors R&D for several years. For his contributions to aerospace and other areas, he had been honoured twice by the prestigious DRDO Academy Excellence Award (1999 and 2012) and the System Society if India Gold Medal (1998-99). Earlier in his career he had been awarded Jagadish Bose National Science Talent search Scholarship and the Commonwealth Fellowship, U.K. As Principal Investigator, Joint Principal Investigator and Co-Investigator, Prof. Ghoshal has carried out successfully more than 20 research projects worth about Rs. 60 Million sponsored by different agencies. He has served in several national technical committees as chairperson and members. He had been Chancellor‟s nominee in the senates of Viswa Bharati University and Nagaland University. He has served two successive terms as the member of Research Council of National Aerospace Laboratory, CSIR, Bangalore. He has served as a member of the Rama Rao committee set up by the Ministry of Defence. He has authored more than 40 technical papers in refereed technical journals and about 60 technical reports. He has Guided 11 Ph.D. (Engg.) Theses and 40 Masters Degree Theses. At present 2 Ph.D (Engg) work are awaiting evaluation and two are in progress

Abstract: The speaker had been fortunate to witness the evolution of control engineering as applied to industrial processes, manufacturing and aerospace domains in various capacities like designer, validator or simply as a keen observer. In the prologue, the speaker describes the circumstances which made such an experience possible. In this short lecture, the speaker traces such evolution in the fields of Aircraft Flight Control, Missile Guidance and control, Stabilization of trackers/seekers, and control of aircraft propulsion (gas turbine) control. Several definitions are clarified and established in the introductory part to facilitate uniform vocabulary and nomenclature. These definitions include Guidance, Navigation, Flight Control, Effectors and Actuators. Some basic aspects of control architecture and design approaches are also briefly introduced. This includes minor loop design, harmonized use of feedback and feed forward, gain scheduling, use of limiters and special nonlinearities like max and min selectors and simple measures of robustness. Special considerations for robust stabilization of unstable plants are also discussed. The speaker provides examples of how aerospace systems provide a rich set of challenging problems for Control Engineers. Such systems had been the primary motivator for establishing many new theories and technologies in Control. Also argued in this part how the aerospace systems provided validation ground for much complex control, estimation and signal processing theories which were not previously applied anywhere. In the evolution of fixed wing aircraft flight control, SAS, Yaw damper leading finally to fullfledged FCS is traced. The concept of "handling quality" is introduced. The methodology for validation of control law is touched upon. This is followed by a brief enumeration of conventional autopilot schemes. Special consideration for missile flight control system is then introduced and a few representative control structures are described. Three fire and forget type missile guidance schemes, namely, ballistic Missile Guidance, homing guidance for ATM and trajectory hugging guidance are described. For gas turbine, the lecture briefly describes the evolution from hydraulic control to the digital engine control (DECU). Control architecture of contemporary DECU is explained emphasizing interesting control considerations, including why such a control system is often called a hybrid system. Future possibilities of Research and Design in the areas of Rotorcraft, UAV and gas turbine controls (DECU) are suggested.

Dr. Rakteem Bhattacharya

Associate professor
Texas A&M University
USA

Research Interest: Computational Methods for Uncertainty Quantification in Space Situational Awareness

Profile: Prof. Raktim Bhattacharya received his M.S. and Ph.D. degrees in aerospace engineering from the University of Minnesota in 2000 and 2003, respectively. He was a postdoctoral scholar at Caltech from 2003-2004 in the department of Control and Dynamical Systems. After that he was employed by United Technologies Research Center as a research scientist from 2004-2005. He joined the aerospace engineering department of Texas A&M University in 2005 and currently is an associate professor. His research interests include robust control and estimation, nonlinear dynamics, uncertainty quantification and convex optimization. His research is supported by NSF, AFOSR and NASA.

Abstract: In this talk, we compare satellite state estimation algorithms in the equinoctial coordinate system, which is a subset of $R5 \times S$, where R is Cartesian and S is circular. The comparison is made between an optimal transport (OT) based filtering and ensemble Kalman filtering (EnKF) algorithm. State joint probability density function is modelled in $R5 \times S$ using Gauss Von Mises distributions. The sensor noise for OT is modelled in the same manifold. EnKF, by definition, requires the sensor noise to be Gaussian and is modelled in R6 for this problem. We show there is a clear advantage for using an OT based filtering algorithm where uncertainty in initial conditions and sensor noise are represented in cylindrical manifolds. The two algorithms are implemented on a simulated International Space Station (NORAD 25544) orbit, with only one measurement per day. We compare two scenarios in the simulation based study. In the first study, sensor noise characteristics are assumed to be known. In the second study, we present a new algorithm in OT framework with unknown sensor noise characteristics, which is practical and relevant to space-tracking problems. In both the cases, the OT based algorithm is stable and tracks with very high accuracy. EnKF, on the other hand, is unstable and quickly diverges.

Dr.B.V.S.S.S.Prasad

Professor and Head
Department of Mechanical Engineering
IIT, Madras

Research Interest: Gas Turbine Blade Cooling Technologies

Profile: Dr.B.V.S.S.S.Prasad graduated in 1979 from Jawaharlal Technological University College of Engineering Kakinada, Andhra Pradesh, India in Mechanical Engineering. He obtained his M.Tech and Ph.D degrees in Mechanical Engineering from Indian Institute of Technology Kharagpur from 1981 and 1985 respectively.He worked as lecturer (1985-90) and Assistant Professor (1990-95) at IIT Kharagpur. He is currently Professor and Head of the Department of Mechanical Engineering at Indian Institute of Technology Madras. He is also the principal coordinator of the CFD Centre at IIT Madras.Dr. Prasad was a visiting Professor and research scientist at the Technical University of Nova Scotia, Halifax, Canada and University of Michigan Dearborn, U.S.A. respectively. He collaborated with Chalmers University, Sweden, Abo Academi, Finland and Penn State University, USA for industry related projects.His research areas include thermo fluid dynamics, turbo-machines, energy conversion technologies including fluidization technology and CFD. The heat flux gauges developed by him are widely used by several research investigators and industrial users in India.Dr. Prasad guided 13 Ph. D and 70 masters' students. He published about 150 research papers in various International Journals and conference proceedings. He edited 8 conference proceedings and organized several conferences and workshops.Dr.Prasad undertook94 sponsored and consultancy projects for the government as well as public and private sector organizations.He is a life member of K-14 (Heat Transfer) group of IGTI (ASME).He was Secretary of the Indian society for Heat and mass Transfer from 2002-2006. He is currently the President of Fluid Mechanics and Fluid Power Society.

Abstract: Efficiency is a basic criterion for evaluation of performance of a gas turbine system. An increase of Turbine Inlet Temperature (TIT) leads to higher efficiency, but TIT is limited by the withstanding temperature of turbine blade material. Several internal and external cooling techniques are used to meet the requirements of increasing TIT. Gas turbine blade cooling technology is complicated because a single blade involves various cooling techniques at different sections viz., the leading edge, the main body, the trailing edge, the end wall and the tip-turn. The techniques discussed will include convection and impingement cooling under internal cooling whereas film, effusion, pin fin and transpiration cooling under external cooling. Several new cooling concepts which involve alternate geometries and designs such as swirl chambers, chevron nozzles, coaxial jets, inclusion of small solid particles in flow, improved design of exit pathways for spent flow in array installation, rib tabulators, matrix network, latticework channel, mist cooling, unsteady/ pulsed jets etc. will be critically reviewed in this paper. The parameters chosen are various dimensionless numbers like Mach number, Reynolds number, Sherwood number, and dimension/shape/alignment and spacing between jets/ film holes/ orifice/ protrusion/ dimples and the dimension of target surface, pressure drop and rotational effects. The proposed paper will also discuss experimental and numerical research methods to find out most approachable means for estimating heat transfer characteristics of any turbine cooling technology.

Mr. S Somnath

Director
Liquid Propulsion Systems Centre, ISRO
Research Interest: Liquid Propulsion

Profile: Mr. S. Somanath, a 'Distinguished Scientist', is currently the Director of Liquid Propulsion Systems Centre (LPSC), one of the major Centres of the Indian Space Research Organisation (ISRO), having its Headquarters at Valiamala in Thiruvananthapuram District and a Unit at Bangalore.LPSC is engaged in the development of Liquid and Cryogenic Propulsion Stages for Launch Vehicles and Auxiliary Propulsion Systems for both Launch Vehicles and Satellites. All activities relating to Liquid Propulsion Stages, Cryogenic Propulsion Stages and Control Systems are being carried out at LPSC,Valiamala.The Transducer Fabrication facilities and integration of Satellite Propulsion Systems are carried out at LPSC, Bangalore. Before assuming charges as Director, LPSC, he served in ISRO's Vikram Sarabhai Space Centre (VSSC) and held various important positions such as Project Manager-Polar Satellite Launch Vehicle (PSLV), Deputy Director for Structures Entity/Propulsion & Space Ordnance Entity, Project Director, Geosynchronous Satellite Launch Vehicle (GSLV Mk-III) and Associate Director (Projects), VSSC.

Mr.Somanath joined VSSC as Scientist/Engineer in 1985, after completing graduation in Mechanical Engineering. He has secured his Post Graduation in Aerospace Engineering, with Gold Medal, from Indian Institute of Science (IISc),Bangalore.He is an expert in the area of Structural mechanics, Structural dynamics, Mechanisms, Pyro systems and Launch Vehicle integration.He is also the recipient of Space Gold Medal from Astronautical Society of India (ASI), Performance Excellence Award and Team Excellence Awards from ISRO.He is a Fellow of Indian National Academy of Engineering (INAE) and Corresponding Member of International Academy of Astronautics (IAA)

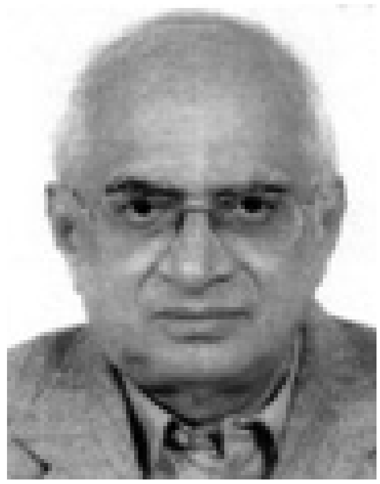
Dr. Abhijit Kushari

Professor
Department of Aerospace Engineering
Indian Institute of Technology, Kanpur, India

Research Interest: Control of “Hooting” in a Gas Turbine Combustor

Profile: Dr. Abhijit Kushari obtained his B. Tech in Aerospace Engineering from IIT Kharagpur in 1994. He joined the School of Aerospace Engineering at Georgia Institute of Technology, Altanta, in 1994 and earned an MS degree in 1996. Subsequently, Dr.Kushari earned his PhD from Georgia Institute of Technology, in 2000 and joined the Department of Aerospace engineering at IIT Kanpur as an Assistant Professor in 2001. He became a Professor in 2014. His research interests are Aerospace Propulsion, Gas Turbine engines, Turbo-machinery, Liquid Atomization, Flow Control and Combustion dynamics. He has authored more than 135 technical papers in various journals and conference proceedings. He has supervised 6 Phd theses and 9 theses are currently ongoing. He has also supervised about 50 M. Tech theses in Aerospace Propulsion and related fields.

Abstract: Aero-engines are quite noisy. The engine-induced noise can cause severe discomfort to the crew, passengers and neighbours. It can be very annoying at times. There has been substantial development in the mitigation of engine noise over the years. However, two sources of noise, i.e., fan noise and combustor noise, persist till date. Combustion noise, called “hooting”, is due to the coupling of different modes of combustor chamber acoustics, heat release oscillations due to the inherent unsteadiness of the combustion process and the convective mode of the burned products. This study is focused on a systematic experimental program to understand the complex physics of liquid fuel combustion is a swirling flow of air, in the presence of other air streams such as quenching air, atomizing air and secondary air in a simulated gas turbine combustor. The results show strong influence of the interaction of the burned products from the primary zone and the air introduced in the secondary zone in the production of broadband noise in such systems. The unsteady pressure data is measured and analysed using nonlinear time series analysis. The Autocorrelation coefficient and the phase state reconstruction reveals the existence of several complex states. An effort has been made to reduce this combustion-generated noise while maintaining the global Fuel to air ratio (FAR) constant by superimposing a periodic oscillation over the mean fuel flow rate. A reduction of more than 15 dB in the SPL through this active control method was achieved. While a passive control technique of re-distribution of air flow rates among different inlets reduced the SPL by more than 20 dB. Plausible reasons for this reduction of sound pressure level are presented



Dr. Prosun Kumar Datta

Former Head & Professor
Department Of Aerospace Engineering
I.I.T Kharagpur

Profile: Professor Datta was born in March 21, 1947 in Calcutta, India. He graduated with a B.Tech (Hons) in Aerospace Engg. from Indian Institute of Technology, Khgaragpur and a M.S. and Ph.D. in Aerospace Engineering from Georgia Institute of Technology, U.S.A. He worked as a visiting fellow (Royal Society/Nuffield Foundation Fellowship) at the Institute of Sound and Vibration Research (ISVR), University of Southampton, U.K. during the year 1978-79. He was a visiting fellow at the International Centre for Theoretical Physics (ICTP) under the sponsorship of UNESCO during the year 1976.

Prof. Datta was visiting Professor in Iraq during the year 1977-78 and later in 1985-87 under the Foreign Assignment Scheme (FAS) of Government of India. He was a visiting Professor at Aerospace Engineering Department, Chosun University, Korea, supported by Korea Research Foundation during the year 2009-10.

Prof. Datta joined as faculty in Aerospace Engineering at IIT Kharagpur during the year 1972 till the end of Dec. 2015, a continuous service of more than 43 years and served as head of the department for two terms. Prof. Datta visited numerous countries such as U.S., U.K., Canada, Korea and Japan to participate in International conferences and as Keynote/ Invited speakers. He is member of several International Societies such as SigmaXi, USA. He is the recipient of Excellence in Teaching Award from Aeronautical Society of India and mentioned in 'Whose and Who in the world' for its several editions.

He published around 135 papers in referred international journals. His research contributions have been cited in ASME and in edited technical books. His research interests are in the area of Applied Mechanics, Aeroelasticity and Structural Dynamics.

Abstract: In general, forces acting on Aerospace structures can be divided into two categories: 1) Conservative forces, 2) Non-conservative forces. Aeroelastic effects occur due to highly flexible nature of the structure, coupled with the unsteady aerodynamic forces, causing unbounded static deflection (divergence) and dynamic oscillations(flutter). Flexible wing panels subjected to jet thrust and missile type of structures under end rocket thrust are non-conservative systems. Here the structural elements are subjected to follower kind of forces, as the end thrust follow the deformed shape of the flexible structure.

When a structure is under a constant follower force whose direction changes according to the deformation of the structure, it may undergo static instability(divergence) where transverse natural frequencies merge into zero and dynamic instability(flutter), where two natural frequencies coincide with each other resulting in the amplitude of vibration growing without bound.

However, when the follower forces are pulsating in nature, another kind of dynamic instability is also seen. If certain conditions are satisfied between the driving frequency and the transverse natural frequency, then dynamic instability called 'parametric resonance' occurs and the amplitude of transverse vibration increases without bound.

The present lecture will discuss the Aeroelastic bahaviour of Aerospace structures under non-conservative forces.