

## Distinguished Lecture On

### Advanced Antenna Systems for 21<sup>st</sup> Century Satellite Communication Payloads

By

**Dr. Sudhakar Rao**

**Technical Fellow, Engineering & Global Products Division**

**Northrop Grumman Aerospace Systems, USA**

**Date : 28 March 2017 (Tuesday)**  
**Time : 10:30 am – 12:30 pm**  
**Venue : Room 15-202, meeting room of State Key Laboratory of Millimeter Waves, 15/F,  
Lau Ming Wai Academic Building, City University of Hong Kong**

#### Abstract

21<sup>st</sup> century has so far seen several new satellite services such as local-channel broadcast for direct broadcast satellite service (DBS), high capacity K/Ka-band personal communication satellite (PCS) service, hosted payloads, mobile satellite services using very large deployable reflectors, high power hybrid satellites etc. All these satellite services are driven by the operators need to reduce the cost of satellite and pack more capability into the satellite. Antenna sub-system design, mechanical packaging on the spacecraft, and RF performance become very critical for these satellites. This talk will cover recent developments in the areas of antenna systems for FSS, BSS, PCS, & MSS satellite communications. System requirements that drive the antenna designs will be presented initially with brief introduction to satellite communications. Reflector and array antenna designs will be covered in this talk.

Advanced antenna system designs for contoured beams, multiple beams, and reconfigurable beams will be presented. Contoured beam antennas using dual-gridded reflectors, shaped single reflectors, and shaped Gregorian reflectors will be discussed. Multiple beam antenna (MBA) concepts and their advantages compared to conventional contoured beams will be introduced. Various designs of the MBA for DBS, PCS, and MSS services will be discussed along with practical examples. Recent advances in feed technology and reflector technology will be addressed with few examples. Advances in multi-band antennas covering multiple bands will be presented. Topics such as antenna designs for high capacity satellites, large deployable mesh reflector designs, low PIM designs, and power handling issues will be included. Brief introductions to TT&C antennas, passive inter modulation products (PIM) and multipaction for satellite payloads will be given. Future trends in the satellite communications including use of higher frequency bands will be discussed. At the end of this talk, engineers will be exposed to typical requirements, designs, hardware, software, and test methods for various satellite antennas.

#### Biography

**Sudhakar K. Rao** received B.Tech, M.Tech, and Ph.D degrees in electronics & communications engineering from REC Warangal, IIT Kharagpur, and IIT Madras in 1974, 1976, and 1979 respectively. During the period 1976-1977 he worked as a Technical officer at ECIL Hyderabad and then as a Senior Scientist at the Electronics and Radar development Establishment, Bangalore on phased array antennas for airborne applications during 1980-1981. He worked as a post-doctoral fellow at University of Trondheim, Norway and then as a research associate at University of Manitoba during 1981-1983. During 1983-1996, he worked at Spar Aerospace Limited (now MDA), Montreal, Canada, as a Staff Scientist and developed advanced antennas for several satellite communications. From 1996-2003 he worked as Chief Scientist/Technical Fellow at Hughes/Boeing Satellite Systems and developed multiple beam antennas and reconfigurable beam payloads for commercial and military applications. During the period 2003-2010, he worked as a Corporate Senior Fellow at Lockheed Martin Space Systems and developed antenna payloads for fixed satellite,



broadcast satellite, and personal communication satellite services. He invented novel high power TVAC test methods for satellite payloads using “pick-up horn absorber loads” that have about 8 times cost and schedule savings which has been successfully used on more than 10 satellite payloads. He is currently a Technical Fellow at Northrop Grumman Aerospace Systems, Redondo Beach, CA working on advanced antenna systems for space & aircraft applications.

Dr. Rao developed antenna payloads for more than 70 satellites including first mobile satellite M-Sat, first Direct Broadcast Satellite with local channels (DirecTV-4S), and first multiple beam antenna at Ka-band for personal communications satellites. His work on development of radiation templates for complex radiation patterns of satellite antennas for interference analysis was adopted and recommended by the International Telecommunication Union (ITU)/CCIR in 1992 as the world-wide standard for satellite manufacturers and operators. He authored over 170 technical papers and has 44 U.S patents. He authored and co-edited three text book volumes on “Handbook of Reflector Antennas and Feed Systems” that are published in June 2013 by the Artech House.

Dr. Rao became an IEEE Fellow in 2006 and a Fellow of IETE in 2009. He received several awards and recognitions that include 2002 Boeing’s Special Invention Award for series of patents on satellite antenna payloads, 2003 Boeings’ technical achievement award, Lockheed Martin’s Inventor of Technology award in 2005 & 2007, IEEE Benjamin Franklin Key Award in 2006, Delaware Valley Engineer of the Year in 2008, and Asian American Engineer of the year award in 2008. He received IEEE Judith Resnik Technical Field Award in 2009 for pioneering work in aerospace engineering. He is the recipient of the IETE’s 2015 Prof. S.N. Mitra Memorial award and the Distinguished Alumni Professional Achievement Award from his almatem National Institute of Technology, Warangal, India in 2016. He received best reviewer recognition by the IEEE Transactions on Antennas & Propagation Journal for the years 2014 and 2015. Dr. Rao is appointed as the Distinguished Lecturer by the IEEE APS for a three year period (2014-2016). He was the Chair for the IEEE APS “Industry Initiatives Committee” during 2010-2015, Associate Editor for the IEEE Antennas & Propagation Magazine’s “Antenna Applications Corner”, Associate Editor for the IEEE Transactions on Antennas & Propagation, Special Session Organizer/Chair for the last six IEEE APS/URSI Symposia, Technical Program Committee member for IEEE APS/URSI Symposia from last 10 years, and reviewer for the IEEE AP Transactions, WPL, IEE etc.

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**Enquiries:**

Dr. Hang Wong, Department of Electronic Engineering

Tel.: (852) 3442 5935 Fax: (852) 3442 0562 Email: [hang.wong@cityu.edu.hk](mailto:hang.wong@cityu.edu.hk)