The Future of Spaceborne Antennas?

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Abstract/Keywords

Abstract: In last three decades, antenna techniques have been rapidly developed for consumer electronics, biomedical applications, defense and space applications, etc..

In this presentation, we would pose some questions for professors/researchers/engineers/students to think about the antennas for space/satellite applications. What is the future of antenna techniques to meet the stringent requirements for space/satellite applications? How can vector antennas, smart skin antennas, THz antennas, metamaterial antennas, shared aperture antennas, reflectarray antennas and other novel antenna theories be applied to space/satellite platforms?

Keywords: vector antennas, smart skin antennas, THz antennas, metamaterial antennas, shared aperture antennas, reflectarray antennas, future of antennas for space and satellite platforms

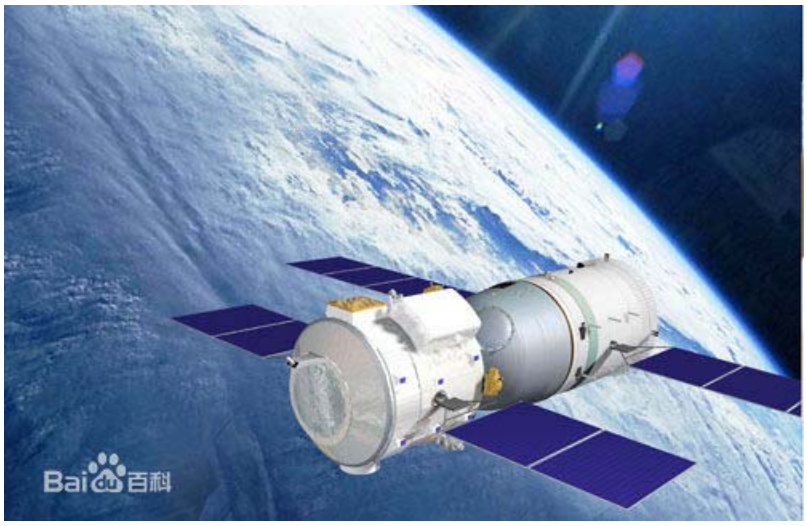
Briefbio

Dr Yong Xin Guo joined the Department of Electrical and Computer Engineering, National University of Singapore (NUS), as an Assistant Professor in February 2009 and was promoted to an Associate Professor with tenure in Jan 2013. He received the B.Eng. and M.Eng. degrees from Nanjing University of Science and Technology, Nanjing, China, and the Ph.D. degree from City University of Hong Kong, all in electronic engineering, in 1992, 1995 and 2001, respectively. From September 2001 to January 2009, he was with the Institute for Infocomm Research, Singapore, as a Research Scientist.

He has authored or co-authored 171 international journal papers and 176 international conference papers. Thus far, his publications have been cited by others more than 2086 times and the H-index is 28 (source: Scopus). He holds one Chinese Patent, one U.S. patent and one filed PCT patent. His current research interests include small and wideband patch antennas, implantable/wearable antennas, on-chip antennas and antennas in package, RF energy harvesting and wireless power, MMIC modeling and design, etc..

Dr Guo was General Chairs and TPC Chair for a few IEEE conferences. He is serving as Associate Editors for the IEEE Antennas and Wireless Propagation Letters (AWPL), IET Microwaves, Antennas & Propagation and Electronics Letters. He was a recipient of the Young Investigator Award 2009, National University of Singapore. He received 2013 Raj Mittra Travel Grant Senior Researcher Award. He received the Best Poster Award in 2014 International Conference on Wearable & Implantable Body Sensor Networks (BSN 2014), Zurich, Switzerland. He is a co-recipient of of Design Contest Award of the 20th International Symposium on Low Power Electronics and design (ISLPED), Rome, Italy, July 2015. His PhD students received Best Student Paper Awards from IEEE MTT-S IMWS-Bio 2015 in Taiwan, IEEE iWEM 2013 in Hong Kong, 2011 National Microwave and Millimeter-Wave Conference at Qingdao, China and IEEE ICMMT 2010 in Chengdu, China.

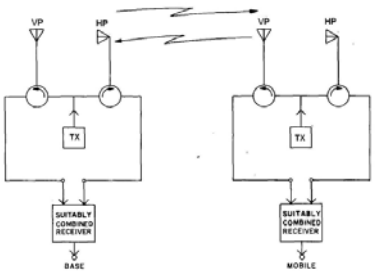
1. Antenna Introduction



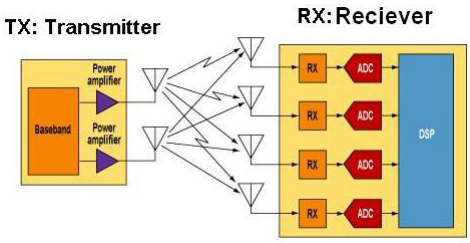
Shenzhou VI Spacecraft (launched in 2005) , From (Baidu)

2.Issues——Vector Antenna Element and Array

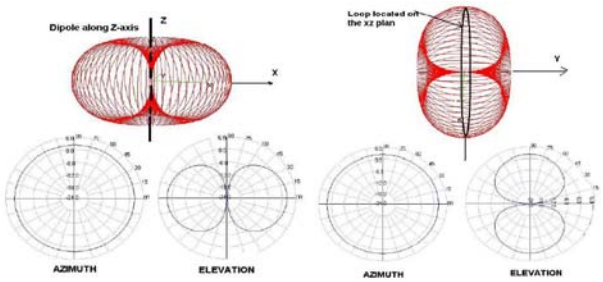
1)、Polarization Diversity



2)、Spatial Diversity

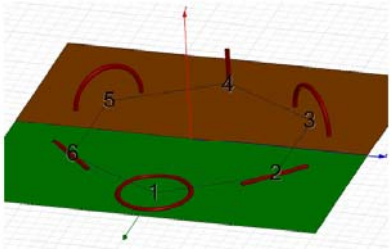


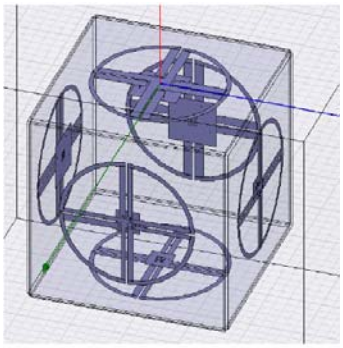
3)、Antenna Pattern Diversity



(a) Dipole along the z-axis (b) Loop located on the yz plane

2.Issues——Vector Antenna Element and Array





6D Distributed Vector Sensor

1、What is the total pattern?

2、Is it an omnidirectional antenna?

3、Is it only a multiple polarization antenna?

4、How to test its final pattern?

5、How to form an array?

2.Issues——Smart Skin

- The smart skin is a composite layer which may contain conformal radars, conformal microstrip or log-periodic type antennas or spiral antennas for electromagnetic applications.

- A structurally integratable conformal antenna demands that the functional components be highly integrated both conceptually and in practice.

  Is Smart skin concept still a key direction to be worthy of further research for spaceborne antenna designers in the future?

2.Issues——THz Antenna

Can it be used to spaceborne communications especially for satellite interlink communications or Is it abandoned in the near future because the spaceborne laser communication systems are rapidly developed?

2.Issues——Metamaterial Antennas

Can metamaterial antennas be used to broadband communication systems in the near future?

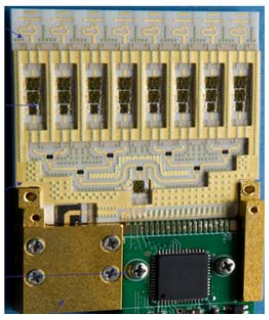
2.Issues——Others

- **Shared Aperture or Multifunction Antennas**
- **Reflectarray Antennas**
- **Mechanism of Passive Intermodulation**
- **Are there any Novel Antenna and Microwave Theories?**

What is the Future For Antenna Designers?

With the developments of MMIC, LTCC and other techniques, an antenna, especially an active antenna, is increasingly becoming a highly integrated smart system, which involves a tangle of complex technological issues:

- **Mechanical structure,**
- **Thermal management,**
- **Module replaceability,**
- **Size constraints,**
- **Module complexity,**
- **Cost, and Hermeticity,**
- **MMIC or Chip performance**, etc



What is the future for antenna designers?

Thanks!