DRA SHORT COURSE

1. Course header

a. Course title : Dielectric Resonator Antennas, Theory, Design with Recent Developments
b. Course type: Full day
c. Contact person : Prof. Ahmed Kishk, University of Mississippi, Department of Electrical Engineering, University, MS 38677, ahmed@olemiss.edu, (662-915-6523)

2. Course description

a. Who should attend this course and why: This course is intended for graduate students, engineers, and professionals who are interested in high efficient antennas and who are looking for alternatives to the existing traditional antennas. It is also for researchers looking for innovative antenna designs. Researchers looking for high efficient antennas for millmeter frequencies are also encouraged to attend.
b. Course topics, and names of instructors:

   Prof. Ahmed Kishk, University of Mississippi, Department of Electrical Engineering, University, MS 38677, ahmed@olemiss.edu, (662-915-6523)

Abstract: Recently, interest in dielectric resonator antennas has increased because of their attractive features such as small size, high radiation efficiency (98%), wide bandwidth, and high power capability for radar applications and base stations. The dielectric resonator antenna is made from high dielectric constant materials and mounted on a ground plane or on a grounded dielectric substrate of lower permittivity.

The short course will start by a short overview for the development of the dielectric resonator antennas. The theory of operation will be discussed step by step to provide basic understanding. The discussion is provided in simple forms to satisfy audience of different background levels. Design curves will be provided for the circular disc and hemisphere dielectric resonators. Use of these models with other geometries is discussed.

Different excitation mechanisms are demonstrates such as the probe, slot, image line and waveguides. Applications of dielectric resonators in arrays are provided with discussion on the mutual coupling level and the wide scanning capabilities of the dielectric resonator antenna array. The array bandwidth limit is discussed based on the element size and the spacing between the array elements.

Techniques for broadband applications are discussed. Some of the techniques are based on the material properties and some depends on the DRA shape. Several examples are provided. Some elements would provide a matching bandwidth over 40% with reflection coefficients better than –10dB for 50 Ohms ports. Finally, Techniques for size reduction of the DRA are presented to demonstrate the flexibility of the DRA to satisfy the required small size for some applications. The technique will result in small size and keeping wide bandwidth. The applications of the DRA for spatial power combiners are presented. The DRAs are placed in an oversized hard horn to provide uniform field distribution. Resent developments of the dielectric resonators as a multifunction device will be also provided. In this application we will show the use of the same DR as an antenna with low quality factor and as a resonator with high Q-factor.

c. Means of instruction (if different from slides). Do you plan to use a software? (If so, see below).

3. Course instructors

For **all** involved instructors, please make sure to provide

a. Name, full institutional/professional affiliation, postal and email address, phone number
b. Short bio:

Ahmed A. Kishk received the BS degree in Electronic and Communication Engineering from Cairo University, Cairo, Egypt, in 1977, and in Applied Mathematics from Ain-Shams University, Cairo, Egypt, in 1980. In 1981, he joined the Department of Electrical Engineering, University of Manitoba, Winnipeg, Canada, where he obtained his M.Eng and PhD degrees in 1983 and 1986, respectively.

From 1977 to 1981, he was a research assistant and an instructor at the Faculty of Engineering, Cairo University. From 1981 to 1985, he was a research assistant at the Department of Electrical Engineering, University of Manitoba. From December 1985 to August 1986, he was a research associate fellow at the same department. In 1986, he joined the Department of Electrical Engineering, University of Mississippi, as an Assistant Professor. He was on sabbatical leave at Chalmers University of Technology, Sweden during the 1994-1995 academic years. He is now a Professor at the University of Mississippi (since 1995). He was an Associate Editor of *Antennas & Propagation Magazine* from 1990 to 1993. He is now an Editor of *Antennas & Propagation Magazine*. He was a Co-editor of the special issue, "Advances in the Application of the Method of Moments to Electromagnetic Scattering Problems," in the *ACES Journal*. He was also an editor of the *ACES Journal* during 1997. He was an Editor-in-Chief of the *ACES Journal* from 1998 to 2001. He was the chair of Physics and Engineering division of the *Mississippi Academy of Science* (2001-2002). He was a guest Editor of the special issue on artificial magnetic conductors, soft/hard surfaces, and other complex surfaces, on the *IEEE Transactions on Antennas and Propagation*, January 2005.

His research interest includes the areas of design of millimeter frequency antennas, feeds for parabolic reflectors, dielectric resonator antennas, microstrip antennas, EBG, artificial magnetic conductors, soft and hard surfaces, phased array antennas, and computer aided design for antennas. He has published over 200-refereed Journal articles and 27 book chapters. He is a coauthor of the ***Microwave Horns and Feeds*** book (London, UK, IEE, 1994; New York: IEEE, 1994) and a coauthor of chapter 2 on ***Handbook of Microstrip Antennas*** (Peter Peregrinus Limited, United Kingdom, Ed. J. R. James and P. S. Hall, Ch. 2, 1989). Dr. Kishk received the 1995 and 2006 outstanding paper awards for papers published in the *Applied Computational Electromagnetic Society Journal*. He received the 1997 Outstanding Engineering Educator Award from Memphis section of the IEEE. He received the Outstanding Engineering Faculty Member of the Year on 1998 and 2009, Faculty research award for outstanding performance in research on 2001 and 2005. He received the Award of Distinguished Technical Communication for the entry of IEEE Antennas and Propagation Magazine, 2001. He also received The Valued Contribution Award for outstanding Invited Presentation, "EM Modeling of Surfaces with STOP or GO Characteristics – Artificial Magnetic Conductors and Soft and Hard Surfaces" from the Applied Computational Electromagnetic Society. He received the Microwave Theory and Techniques Society **Microwave Prize** 2004. Dr. Kishk is a ***Fellow*** member of IEEE since 1998 and Fellow of Electromagnetic Academy. He is a member of Antennas and Propagation Society, Microwave Theory and Techniques, Sigma Xi society, U.S. National Committee of International Union of Radio Science (URSI) Commission B, Phi Kappa Phi Society, Electromagnetic Compatibility, and Applied Computational Electromagnetics Society.

4. Additional Information (optional)

Has this or a similar course already been offered at a conference? If so: What conference (and what year)? How many people attended it?

This course has been offered before at several conferences. It has been offered three times before at Eucape. The number of attendees uses to be around five each time. At one time it was around 16 attendees. Each time new materials are presented to present the latest developments in the topic.

IMPORTANT NOTICE about use of proprietary/commercial software.

Use of software is often very appropriate and generally encouraged; however, care must be exercised so that this does not circumvent EUCAP policy on commercial products and their natural advertising or environment, that is, the Exhibition. Also, it is generally expected that a course instructing how to use commercial software or hardware instruments should be free of charge to registered conference participants.

If you plan to use a code that is commercial or proprietary please make sure you properly notify also the Conference General Chair.