

THE BEEET



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Joint Chapter Meeting:

Radiation Quality Factor Q for Electrically Small Spherical Antennas with Magneto-Dielectric Material Cores

SPEAKER: Dr. Olav Breinbjerg

Technical University of Denmark

LOCATION: University of Arizona, Room ECE 530

DATE: Monday January 10, 6:00 pm

Refreshments Provided (pizza and soft drinks)

The presentation reviews recent results for the radiation quality factor Q for electrically small, spherical antennas with magneto-dielectric material cores. The well-known Chu lower bound Q_{Chu} is based on the stored energy external to the spherical antenna and can thus be achieved only if the stored internal energy approaches zero. For an air-core spherical antenna, Wheeler and Thal have shown that this internal energy results in a quality factor of $1.5Q_{Chu}$ for an electric dipole antenna and $3.0Q_{Chu}$ for a magnetic dipole antenna. We investigate the influence of a magneto-dielectric core on the internal energy of a magnetic dipole antenna and show that this energy can be significantly reduced by either a solid magnetic core or a magnetic-coated PEC core. We derive a new lower bound on Q for the solid magnetic core and demonstrate that Q_{Chu} can be approached arbitrarily close for the magnetic-coated PEC core. Theoretical results based on spherical vector wave expansion as well as computational and experimental results are presented.

BIOGRAPHY

Olav Breinbjerg was born in Silkeborg, Denmark. He received the M.Sc. and Ph.D. degrees in electrical engineering from the Technical University of Denmark (DTU) in 1987 and 1992, respectively. Since 1991 he has been on the faculty of the Department of Electrical Engineering (formerly Ørsted-DTU, Department of Electromagnetic Systems, and Electromagnetics Institute) where he is now Full Professor and

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Head of the Electromagnetic Systems Group including the DTU-ESA Spherical Near-Field Antenna Test Facility. Olav Breinbjerg was a Visiting Scientist at Rome Laboratory, Hanscom Air Force Base, Massachusetts, USA in the fall of 1988 and a Fulbright Research Scholar at the University of Texas at Austin, Texas, USA in the spring of 1995. Olav Breinbjerg's research is generally in applied electromagnetics - and particularly in antennas, antenna measurements, computational techniques, and scattering - for applications in wireless communication and sensing technologies. At present, his interests focus on meta-materials, antenna miniaturization, and spherical near-field antenna measurements. He is the author or co-author of more than 40 journal papers, 100 conference papers, and 70 technical reports, and he has been, or is, the main supervisor of 10 Ph.D. projects. Olav Breinbjerg has taught several B.Sc. and M.Sc. courses in the area of applied electromagnetic field theory on topics such as fundamental electromagnetics, analytical and computational electromagnetics, antennas, and antenna measurements at DTU, where he has also supervised more than 70 special courses and 30 M. Sc. projects. Furthermore, he has given short courses at other European universities. He is currently the coordinating teacher at DTU for the 3rd semester course 31400 *Electromagnetics*, and the 7-9th semester courses 31428 *Advanced Electromagnetics*, 31430 *Antennas*, and 31435 *Antenna Measurements in Radio Anechoic Chambers*. Olav Breinbjerg received a US Fulbright Research Award in 1995. Also, he received the 2001 AEG Elektron Foundation's Award in recognition of his research in applied electromagnetics. Furthermore, he received the 2003 DTU Student Union's Teacher of the Year Award for his course on electromagnetics.

Message From the Section Chair

By Brenda Huettner

I'd like to invite everyone in the Tucson Section to participate in IEEE. In the last year, we've conducted activities for schools, the University of Arizona, the community, and for you, the membership. These activities are a great way to get involved in IEEE and show the impact of engineers in our community.

Each year, we elect new officers, start up a micromouse contest and a student paper contest at the U of A, make preparations for each year's Engineers Week, and organize additional meetings. All of this is done on a volunteer basis.

We have a great core of volunteers but we could always use your help. I'm asking people to get involved. With more people the Tucson Section could do so much more for the membership and this community.

If you're interested in helping out or becoming an officer, contact us through the following website:

<http://www.ieee.org/tucson>

Become an IEEE Senior Member!

Do you want to become a senior member of the IEEE? The IEEE wants to promote qualified candidates to senior membership! If you have 10 years of professional experience of which five years of significant professional performance, you are qualified for a senior member upgrade. Educational experience such as a bachelor's degree in an IEEE-designated field counts 4 years to that number, a master's degree counts 5 years and a doctorate counts 6 years. In order to find out more, point your web browser to www.ieee.org and search for senior membership!

Senior Membership:

<http://www.ieee.org/web/membership/senior-members/>

Applications can be found online. You will need the references of three current senior members or fellows. If you need assistance, contact Joseph Wu at joewu@ieee.org

IEEE Student Members....

Student Paper Contest and Micromouse Competition

The Tucson Section of the IEEE sponsors a Student Paper Contest and a Micromouse competition. Winners can win cash prizes and advance to regional contests and win extra money.

For the Student Paper Contest, entries will be judged by the content of the paper and an oral presentation.

For the Micromouse, teams of students will build a microprocessor controlled mouse to negotiate a maze to find the center.

These contests will be held in March or April of 2011 so stay tuned for details!

Keep Up with the Tucson Section: Join our email list!

The Tucson Section email list delivers the latest IEEE Tucson news right to your email box. To join, simply send an email to

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Upcoming Conferences

2011 Digital Signal Processing and Signal Processing Education Meeting (DSP/SPE) January 04 - 07, The Enchantment Resort, Sedona, AZ

2011 IEEE Radio and Wireless Symposium (RWS), January 16 - 20, Renaissance Glendale Hotel, Glendale, AZ

2011 IEEE Topical Conference on Power Amplifiers for Wireless and Radio Applications (PAWR), January 16 - 20, Renaissance Glendale Hotel & Spa, Glendale, AZ

2011 IEEE Topical Conference on Wireless Sensors and Sensor Networks (WiSNet), January 16 - 20, Renaissance Glendale Hotel & Spa, Glendale, AZ

2011 IEEE Topical Conference on Biomedical Wireless Technologies, Networks, and Sensing Systems (BioWireleSS), January 16 - 20, Renaissance Glendale Hotel & Spa, Glendale, AZ

2011 IEEE 11th Topical Meeting on Silicon Monolithic Integrated Circuits in Rf Systems (SiRF), January 17 - 19, Renaissance Glendale Hotel & Spa, Glendale, AZ

2011 IEEE/PES Power Systems Conference and Exposition (PSCE), March 20 - 23, Phoenix Convention Center, Phoenix, AZ

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We need to hear from you!

How can we make IEEE a better organization? We can only do it with your help. As a volunteer organization, IEEE depends on your participation to accomplish all of our goals.

As you can see from this newsletter, there are lots of activities where you can actively contribute. Are you good at organization? Volunteer to head one of our Chapters or to help organize our general meetings. Want to show off or improve your internet skills? Volunteer to help with our Web site. Interested in promoting our field to the next generation of engineers? Help with Engineers Week, or as a judge for any of our student competitions.

Even if you only have a little bit of time, there's sure to be an IEEE opportunity that will interest you. Even if you have no free time at all, but have ideas for meetings or activities that promote engineering and the IEEE, let us know! We'd like to hear from you. Please contact Joseph Wu at joewu@ieee.org or at 325-4781.

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