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Additional Information

THE IMPORTANCE OF GOOD MEN IN YOUR LIFE!

When I was asked to write about my experience in this section, it was hard for me to think about what I could tell that could be interesting or impact other people.

Of course, I will talk about the scientific achievements that led me to win the IEEE AP-S 2019 Lot Shafai Award, which I consider a great acknowledgment for a mid-term scientific hard-working career. I was 40, just at the age limit, when I applied for the first time, and it was probably the right time to do it, as I have been honored with such a prestigious award. In Fig. 1 you can see a picture of my family and me at the 2019 IEEE AP-S awards ceremony, after receiving the award.

Being the daughter of a Mathematics Professor, I was raised with a very strict education, but also full of important values like effort, dedication, sacrifice, a healthy ambition and love for well-done work.

These values have been vital throughout my life and career, but in these lines, I would like to remark the importance of the person who mentors your career, as well as the person with whom you share your life, especially when you are the mother of two kids (now 7 and 9 years old).

I will tell you a little bit about my professional and personal life and why I think these people (two men, in my case) have such a significant impact on your career.

It all began in 2002 when I got an Erasmus grant to finish my MSc in Electrical Engineering at the Institut für Hochfrequenztechnik (IHF), at the University of Stuttgart (Germany). Personally, living abroad for seven months was an extraordinarily rewarding experience, which allowed me to learn about life and culture in another country, something that I have always found very valuable both for personal and professional growth. During this time, I met my future husband, who was a Spanish engineer working in a research center in Stuttgart. Despite having some job offers in Germany, I decided to go back to Valencia (Spain), mainly because I was not made for the cloudy and cold German winter! So I came back to the Universitat Politècnica de València (UPV) to start pursuing a Ph.D. on the Theory of Characteristic Modes under the supervision of Prof. Miguel Ferrando-Bataller, head of the Electromagnetic Radiation Group at UPV. I had met my supervisor a year earlier while completing an undergraduate grant with his research group for some months. Prof. Ferrando-Bataller's encouragement was crucial for me to enroll in the Ph.D. program, thanks to his ability to transmit his passion for the beauty of antenna research as well as his enthusiasm for research and hard work. So I started my PhD. after being awarded with a 4-year grant of the Spanish Ministry of Science in 2003.

Since then, I started focusing my research on the application of the Theory of Characteristic Modes (TCM) to antenna design. This theory, originally introduced by Prof. Garbacz, Prof. Harrington and Prof. Mautz in the late 1960s [1]-[3], had slipped into oblivion and was virtually unknown within the antenna scientific community. Between 2003 and 2008, our research group revisited the TCM and applied it successfully for antenna design in modern applications. After developing our own Method of Moments-based program for the computation of Characteristic Modes (CM) in PEC bodies with arbitrary shape, we realized the potential of CM attributes (eigenvalues, modal significance and eigencurrents) and their physical interpretation as a foundation to perform systematic antenna design. Moreover, our investigation also focused on efficient mechanisms for the appropriate excitation of CM, which lead to an improvement of the antenna behavior [4].

My supervisor always encouraged me to attend international conferences (see one of the first conferences in Fig. 2) and workshops to present and share our research. I traveled a lot during my Ph.D. studies and I could learn hugely from other researchers' work, while establishing many interesting connections with members of the antenna research community. As a personal note, I can still remember my first conference, the 2004 IEEE AP-S International Symposium in Monterey, CA (USA) where I was stunned by the fact that only a few women were attending the conference. As I could soon notice, this was the rule in antennas and propagation conferences in those days, but nowadays, it makes me happy to notice how much the number of women attending international conferences or workshops has increased. Luckily, things have changed a lot in 15 years! In our research on the TCM, we advocated for the application of CM analysis to a systematic antenna design strategy based on the physical understanding of the potential radiating characteristics of antennas, a powerful aspect unmatched by other existing approaches. We proposed significant designs of antennas based on CM, including a novel feeding technique for planar monopole antennas (double-feeding technique, see Fig. 3) [5] that improves substantially their performance and we also proposed different designs of multimode antennas based on the use of multiple feeding ports [6], as well as work on symmetry conditions for the excitation of modes in a mobile handset chassis [7].

At the 2004 IEEE AP-S Symposium, I presented for the first time to the scientific community the CM of a mobile phone chassis (see Fig. 4) [8], a work that has gathered many citations and set a breakthrough in the design of antennas for mobile handsets. During the last decade, CM of the chassis have been mostly used for the design of MIMO terminals.

In 2005 I earned an Assistant Professor position at UPV and started gathering experience as an academic lecturer while continuing my research. I ended my Ph.D. in 2008, the same year I got married to my husband, who had moved back to Spain a few years earlier. Personally, having a very supportive boyfriend - and later husband - helped me a lot and was a great contribution to my success.

After 2008, the useful and appealing properties of CM and the ever-increasing computational power available spurred a fast-growing interest on this topic within the antenna community [9]. As a result, CM analysis (CMA) has become a powerful tool for antenna design in the last decade, further boosted by the recent inclusion of CMA features in today's most successful commercial electromagnetic simulation packages, including CST, HFSS and Altair FEKO. I have continued working intensively on the design of antennas using CMA, focusing my research on the systematic design of magnetic structures embedded in finite platforms [10], design of lens antennas for 5G systems (see an example in Fig. 5) [11]-[12] and design of electronic-integrated antennas for IoT devices (see an example in Fig. 6) [13][14]. I have been very active in diverse activities related to CM, including courses organized by the European School of Antennas (ESoA) [15], the organization of convened sessions in several international conferences, the participation in the Special Interest Group on Theory of Characteristic Modes (SIG TCM) [16] and the presentation of invited papers on CM in multiple international conferences.

As I said earlier, since my Erasmus experience as a student, I have always found that living abroad and having the chance to work in other laboratories is vital for further development of any career in research. In 2005, during my Ph.D., I spent 4 months at IMST (Kamp-Linfort, Germany) working on mobile handset antenna design. In 2011 my daughter was born, and she was soon followed by my son in 2012. Of course, this had an undeniable impact on my career, because even having a very helpful and

supportive husband, two small kids require a lot of dedication, and I also wanted to enjoy being a mom. In those years, my scientific production decreased, and it took me a great deal of time and effort (much more than expected!) to get back again into full-fledged research work. Meanwhile, in 2012 I earned a permanent position as Associate Professor at UPV and afterward I started to get involved in management activities, by becoming Vice-Director of Research at the Institute of Telecommunications and Multimedia Applications (iTEAM) [17] at UPV in 2016 and the coordinator of the EurAAP Working Group on Small Antennas [18] in 2018. I strongly believe that it is crucial to increase the visibility of women in management positions (especially in technical fields) and we must not evade this responsibility.

Although being in a very comfortable academic situation, in the last years I felt the need to continue growing and evolving as a researcher. Therefore, I decided to visit the Laboratory of Electronics, Antennas and Telecommunications of the University of Nice Sophia-Antipolis (France) for two months in 2018, working on the design of antennas for IoT devices using CM (Fig. 6) [13]. During this two months' research stay, I was in France on my own, while my two kids stayed home with my husband. He understood my need for continuously learning and my eagerness for knowledge and always supported my being abroad for such a long period. Of course, I had to cope with situations where some people (outside the University) told me that I should stay home, taking care of my children, instead of moving abroad, but this is something all women must fight against until our societies normalize the fact that men can take care of their children as well as women. Prof. Ferrando-Bataller was also very supportive of this challenging adventure of moving abroad for a research stay, and he always encouraged me to move forward and leave my comfort zone.

The experience in France was so great from a research perspective that I decided to travel again in 2019 to the USA, where I spent four months in Prof. Manos Tentzeris' ATHENA group at the Georgia Institute of Technology in Atlanta, working in additive manufacturing techniques [19]. After staying on my own for the first two months, my husband and my two kids came to Atlanta and stayed there for the remaining two months. It was an exceptional experience for the whole family, and especially for the kids, as they learned a lot from this international and multicultural experience. Once again, I could count on the unconditional support of both my husband, who took a two-months' unpaid job leave to come to Atlanta, and my mentor, who permanently encouraged me to start this new adventure!

So my experience is that having around you men that encourage, support and understand your needs and inquisitiveness is nowadays very important for women's success, especially when you are married. In my case, thank you to these two men!

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Fig. 1. My family and me in the award ceremony at the 2019 IEEE International Symposium on Antennas and Propagation in Atlanta (USA).



Fig. 2. Me with some other members of the Electromagnetic Radiation Group in Washington D.C while attending IEEE AP-S 2005.

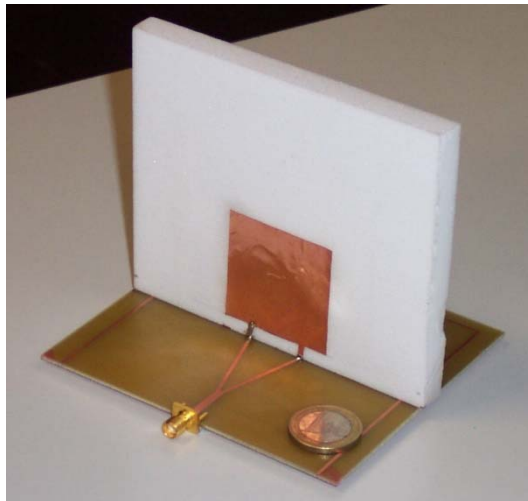


Fig. 3. Prototype of the square monopole with double feed [5].

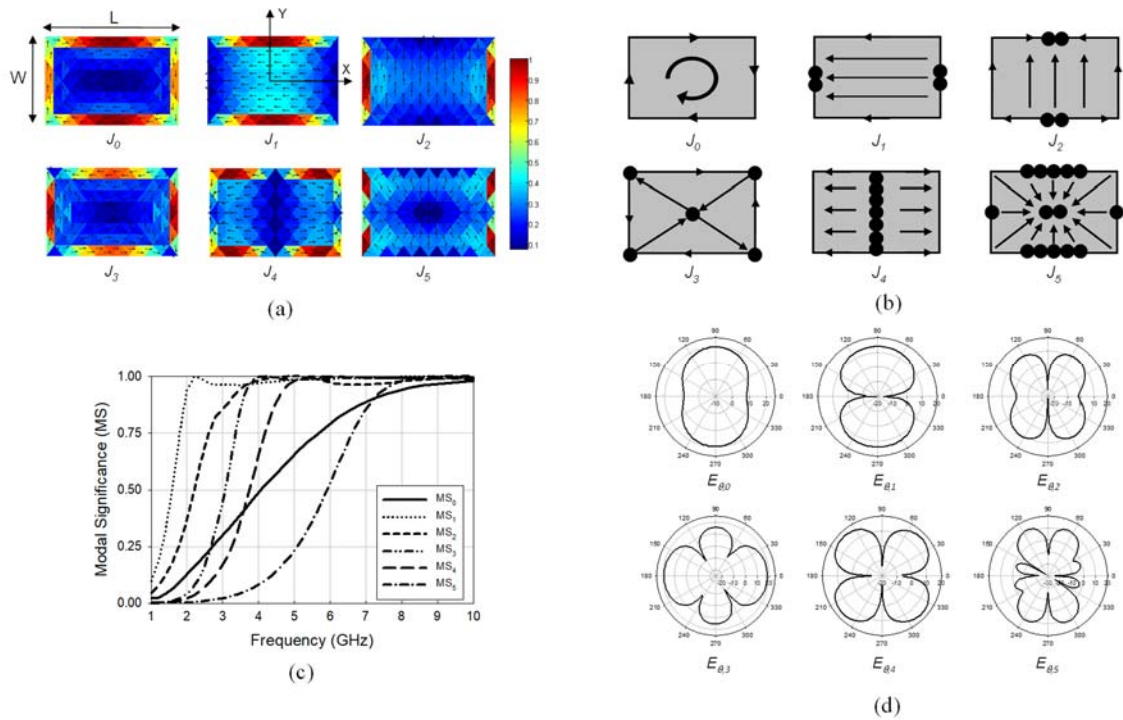


Fig. 4. (a) Normalized current distribution at first resonance ($f=2.4$ GHz) of the first six eigenvectors J_n of a metallic handset chassis of $W=4$ cm and $L=6$ cm; (b) Current schematics of the six modes; (c) Modal significance vs. frequency for the six modes; (d) Radiation pattern associated to the six modes [4].

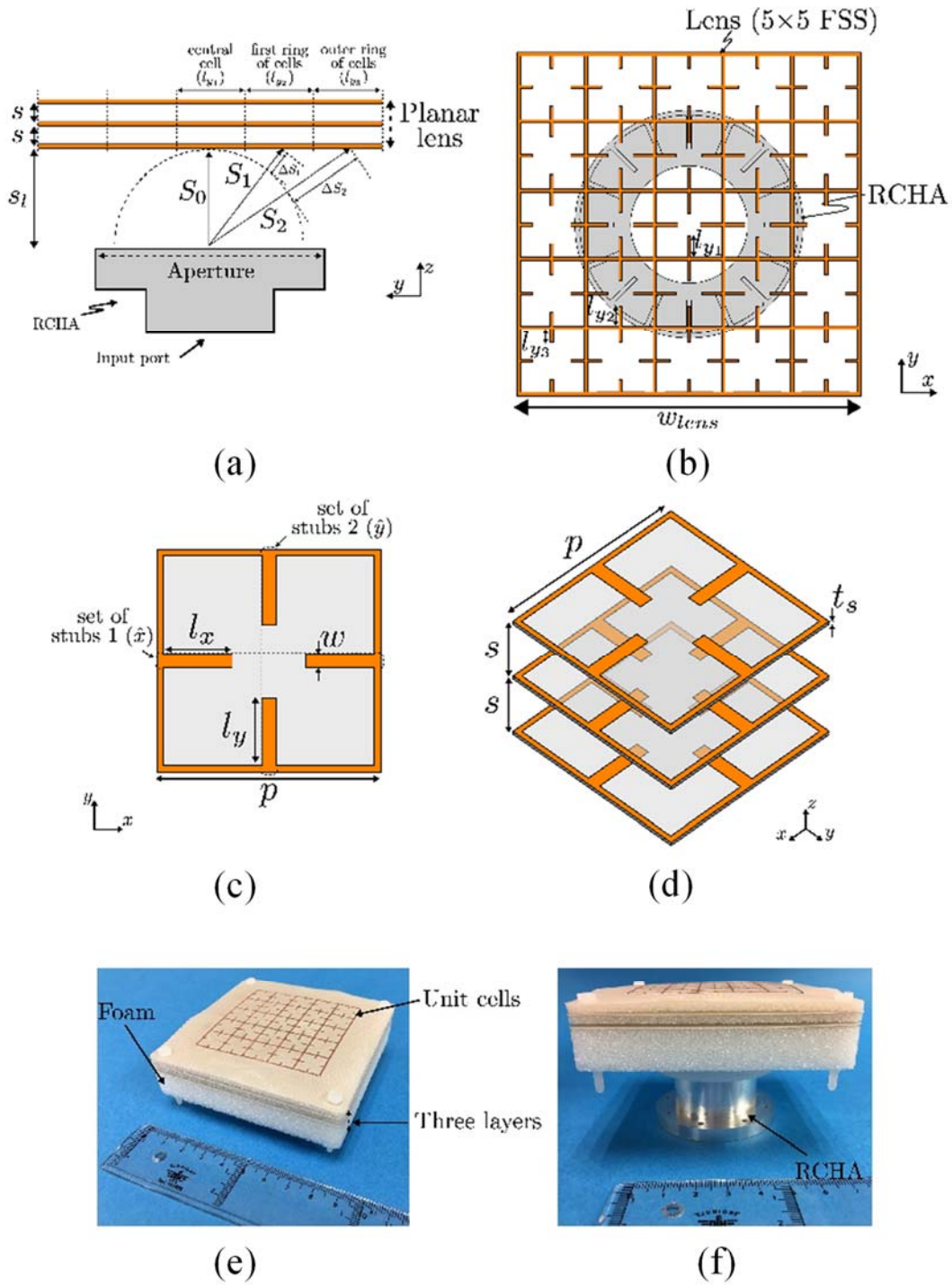
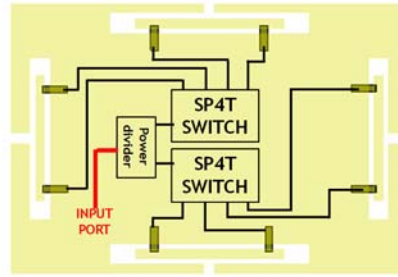


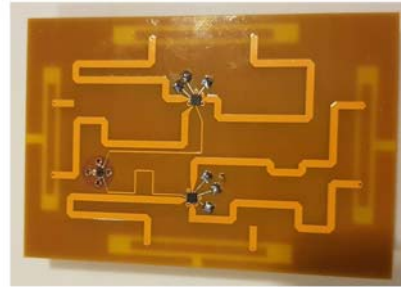
Fig. 5. (a) Lateral view of the proposed 5x5 FSS illuminated by a Radially-Corrugated Horn Antenna (RCHA); (b) upper view; (c) Upper view of the unit cell of the proposed lens; (d) Three-layer unit cell; (e) Fabricated prototype of the three layers lens; (f) Prototype lens fed by the RCHA [12].



(a)



(b)



(c)

Fig. 6. (a) Feeding scheme for a multimode antenna for IoT devices; (b) upper view of the prototype; (c) Lower view [13].