



**Universitat de les
Illes Balears**

EUROWEB PROJECT

FINAL REPORT FROM ACADEMIC TUTOR

Tutor: Guillem Femenias Nadal

Department: Mathematics and Informatics

University: University of the Balearic Islands (UIB)

Post-doctoral student: Aleksandra Panajotovic

Department: Faculty of Electronic Engineering

University: University of Nis (Serbia)

Duration of stay: December 2012 – September 2013 (10 months)

During her stay at the University of the Balearic Islands (UIB), Aleksandra Panajotovic has been doing research with the members of the Mobile Communications Group (MCG) at the Department of Mathematics and Informatics. Her research tutors have been Dr. Felip Riera Palou and Dr. Guillem Femenias Nadal who proposed her to begin working on the topic of multiuser multiple-input multiple-output (MU-MIMO) applied to orthogonal frequency division multiplexing (OFDM)-based wireless local area networks (WLANs). Research on MU-MIMO has recently bloomed, but typically, within the context of orthogonal frequency division multiple access (OFDMA)-based systems such as WiMAX, LTE or LTE-A, and the application of MU-MIMO on a TDMA-based architecture such as that used in ubiquitous IEEE 802.11-based WLANs is far from trivial.

Over the last five years, the Mobile Communications Group at the UIB has kept a very active research thread on WLAN systems that has resulted in a large number of publications (you can see group's webpage at <http://mcg.uib.es>). In particular, over the last two years, members of the group have been working on the issue of fast link adaptation for MU-MIMO-OFDM systems, considering its possible application to IEEE 802.11ac, and Aleksandra has been doing research on this topic to develop a novel multicarrier MU-MIMO technique based on the geometric-mean decomposition (GMD). A publication based on this work has been accepted in IEEE Wireless Days:

A Panajotovic, F. Riera-Palou and G. Femenias, "GMD-enhanced MU-MIMO for IEEE 802.11ac", IEEE Wireless Days, Valencia (Spain), November 2013.

Despite the good results obtained when using the proposed GMD-enhanced MU-MIMO technique, the asymptotic capacity performance curves reveal that there is still room for

significant improvements. More specifically, we have discovered that the use of an alternative transform, namely, the uniform channel decomposition (UCD), plays a crucial role to close, or at least dramatically reduce, the gap between theoretical and practical throughput performance. Nonetheless, the application of UCD to the problem at hand is far from simple and during the last months of Aleksandra's stay she has been working in trying to devise adaptive strategies optimizing the performance of UCD-based MU-MIMO-OFDM schemes. Obtained results are quite promising and we are now preparing both a conference and a journal paper that will be submitted for its possible acceptance for publication.

It is also important to stress that during her stage Dr. Aleksandra Panajotovic has been actively participating in the seminar sessions of our research group. Furthermore, we have been setting the grounds to establish a permanent, and hopefully fruitful, cooperation between our respective research groups at UIB and the University of Nis. To this end, we have been preparing a research project for the next two years including tasks associated to: (1) Optimizing UCD-based MU-MIMO-OFDM for IEEE 802.11ac, (2) Calibration-free link adaptation in multicarrier MU-MIMO, (3) Implementation issues in GMD- and UCD- based MU-MIMO-OFDM schemes, and (4) PHY-MAC cross-layer design. Furthermore, Aleksandra has also been incorporated as a member of the research team of project "AM3DIO: Adaptive Multi-antenna Multi-carrier Multi-user networks based on Distributed Inference and Optimisation", led by Dr. Felip Riera Palou and financed by the Spanish Ministerio de Economía y Competitividad (MINECO).

At a personal level, it is worth pointing out the effort put by Aleksandra to integrate with the rest of research group members by participating in all academic and also social activities carried out within the group. She has fit remarkably well and has proven to be an excellent team player.

Palma, 28 September, 2013



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