



## AVVISO DI SEMINARIO

il giorno **3 Marzo 2010**, con inizio alle **ore 11:00**  
presso l'**aula caminetto** della Facoltà di Ingegneria dell'Università di Firenze  
via Santa Marta 3, 50139, Firenze

il **Dr. Alberto Rabbachin** *Scientific Officer at European Commission, Institute for Protection and Security of the Citizen, European Joint Research Center (JRC), Ispra, Italy*  
terrà un seminario dal titolo

**Part I: Effect of aggregate interference on UWB-IR non-coherent receivers**

**Part II: Statistical modeling of the cognitive network interference**

Chiunque sia interessato è gentilmente invitato a partecipare. Il seminario si terrà in lingua inglese.

### **Abstract:**

#### **Part I: Effect of aggregate interference on UWB-IR non-coherent receivers**

Over the last few years there has been an emerging interest in non-coherent ultrawideband (UWB) communication, particularly as a technology for low-data rate applications because of its low-complexity and low-power consumption. However, the presence of narrowband interference (NBI) and network interference (NWI) severely degrades the communication performance since the energy of the interfering signals is also collected. In this presentation, we compare the performance of two non-coherent UWB receiver structures – the autocorrelation receiver (AcR) and the energy detection (ED) receiver – in terms of the bit error probability (BEP). The AcR is based on the transmitted reference signaling with binary pulse amplitude modulation, while the ED receiver is based on the binary pulse position modulation. We analyze the BEPs for the two non-coherent systems in a multipath fading channel, both in the presence of NBI and NWI. We consider the case with multiple sources of interference, where the interfering nodes with the same carrier frequency are scattered according to a spatial Poisson process. Our framework is simple enough to allow a tractable analysis and provide insights that can be of value in the design of practical UWB systems subject to interference. In particular, we show that the ED receiver is more robust to interference than the AcR, we quantify how the optimal integration time of the receivers depends on the different system parameters, and we establish a clear relationship between the effect of the aggregate and the interferer parameters such as spatial density and power.

#### **Part II: Statistical modeling of the cognitive network interference**

Opportunistic spectrum access allows the opening of under-utilized portions of licensed spectrum for secondary reuse, provided that the transmissions of secondary radios do not cause harmful interference to primary network. Such a system would require secondary users to accurately detect and rapidly react to varying spectrum usage. Therefore, it is important to investigate the effect of cognitive network interference on the primary network at the expense of allowing such secondary spectrum reuse. In this presentation, a new statistical interference model for cognitive network based on the amplitude aggregate interference is shown. The model accounts for the parameters related to the sensing procedure, spatial reuse protocol employed by secondary users, and environment dependent conditions like channel fading and shadowing. We derive the characteristic function and the  $n$ th cumulant of the cognitive network interference on the primary user. By using the theory of truncated-stable distribution, we show how we can approximate the cognitive network interference analytically. We further extend the model to include the effect of power control and show how to apply our model to derive system performance measure such as bit error probability in the presence of cognitive network interference. Numerical results show the effectiveness of our model for capturing the statistical behavior of the cognitive network



interference. Moreover, this work can serve to bring additional understanding of cognitive network interference for successful deployment of cognitive networks in the future.

**Curriculum del Dr. Alberto Rabbachin:**

Alberto Rabbachin received the M.S. degree from the University of Bologna (Italy) in 2001 and the Ph.D. degree from the University of Oulu (Finland) in 2008. Since 2008 he is a Postdoctoral researcher with the Institute for the Protection and Security of the Citizen of the European Commission Joint Research Center. He has done research on ultrawideband (UWB) impulse-radio techniques, with emphasis on receiver architectures, synchronization, and ranging algorithms, as well as on low-complexity UWB transceiver design. He is the author of several book chapters, international journal papers, conference proceedings, and international standard contributions. His current research interests include aggregate interference statistical modeling, cognitive radio, and wireless body area networks. Dr. Rabbachin received the Nokia Fellowship for year 2005 and 2006. He has served on the Technical Program Committees of various international conferences.

Seminario organizzato da:  
Ing. Lorenzo Mucchi