The University of New South Wales

Faculty of Engineering
School of Electrical Engineering & Telecommunications

Invited Talk

On the Robustness of Algebraic STBCs to Coefficient Quantization

Emanuele Viterbo

Professor and IEEE Fellow

Department of Electrical and Computer Systems Engineering

***Associate Dean*, Research Training**

Faculty of Engineering, Monash University

Date: 27 January 2012, Friday
Time: 2:00 p.m. – 3:00 p.m.
Venue: G3, Electrical Engineering Building

Abstract

In this work, we study the robustness of high rate algebraic space-time block codes (STBCs) to coefficient quantization (CQ) at the transmitter in 2 X 2 MIMO fading channels. In particular, we investigate the impact of CQ on the bit error rates of the Golden code and the Silver code with MQAM constellations. We assume infinite-precision operations at the receiver. Towards generating the matrix codewords, we find the minimum number of bits needed to represent and perform the arithmetic operations such that the finite-precision versions of these codes retain their infinite-precision error-performance. We show that the Golden code and the Silver code retain their error performance with as high as 7-bits and 6-bits for 4-QAM constellations, respectively. Also, both codes are shown to need a minimum of 8-bits for 16-QAM constellation. Finally, we propose an example of a full-rate, full-diversity STBC which can be encoded with as low as 3-bits for 4-QAM constellation. The advantages of the proposed code are discussed along with some directions for future work. In this talk, we will discuss how to generate information theoretically secure keys using wireless fading channels. First, a key agreement framework that unifies existing source and channel models for key agreement over wireless fading channels is presented. It is shown that, in general, to fully exploit the resources provided by time varying channel gains, one needs to combine both the channel model and the source model. Asymptotic analyses suggest that in the long coherence time regime, the channel model is asymptotically optimal. On the other hand, in the high signal to noise ratio regime, the source model is asymptotically optimal. Second, the framework is extended to the scenario with an active attacker whose goal is to minimize the key rate that can be generated using our protocol. The attacker's optimal attack strategy is identified. The key rate under this attack model is then characterized.

This is a joint work with J. Harshan.

Biography

Emanuele Viterbo received his degree (Laurea) in Electrical Engineering in 1989 and his Ph.D. in 1995 in Electrical Engineering, both from the Politecnico di Torino, Torino, Italy. From 1990 to 1992 he was with the European Patent Office, The Hague, The Netherlands, as a patent examiner in the field of dynamic recording and error-control coding. Between 1995 and 1997 he held a post-doctoral position in the Dipartimento di Elettronica of the Politecnico di Torino. In 1997-98 he was a post-doctoral research fellow in the Information Sciences Research Center of AT&T Research, Florham Park, NJ, USA. He became first Assistant Professor (1998) then Associate Professor (2005) in Dipartimento di Elettronica at Politecnico di Torino. In 2006 he became Full Professor in DEIS at University of Calabria, Italy. From September 2010 he is Full Professor in the ECSE Department at Monash University, Melbourne, Australia. Prof. Emanuele Viterbo is a 2011 Fellow of the IEEE, a ISI Highly Cited Researcher and Member of the Board of Governors of the IEEE Information Theory Society (2011-2013). He is Associate Editor of IEEE Transactions on Information Theory, European Transactions on Telecommunications and Journal of Communications and Networks, and Guest Editor for IEEE Journal of Selected Topics in Signal Processing: Special Issue Managing Complexity in Multiuser MIMO Systems. In 1993 he was visiting researcher in the Communications Department of DLR, Oberpfaffenhofen, Germany. In 1994 and 1995 he was visiting the Ecole Nationale Suprieure des Telcommunications (E.N.S.T.), Paris. In 2003 he was visiting researcher at the Maths Department of EPFL, Lausanne, Switzerland. In 2004 he was visiting researcher at the Telecommunications Department of UNICAMP, Campinas, Brazil. In 2005, 2006 and 2009 he was visiting researcher at the ITR of UniSA, Adelaide, Australia. In 2007 he was visiting fellow at the Nokia Research Center, Helsinki, Finland. Dr. Emanuele Viterbo was awarded a NATO Advanced Fellowship in 1997 from the Italian National Research Council. His main research interests are in lattice codes for the Gaussian and fading channels, algebraic coding theory, algebraic space-time coding, digital terrestrial television broadcasting, and digital magnetic recording.
Web: http://www.ecse.monash.edu.au/staff/eviterbo/

* * * * * **ALL ARE WELCOME** * * * * * **For ENQUIRIES:** Dr. Wei Zhang (Ph: 9385 4033)