THE CHINESE UNIVERSITY OF HONG KONG
Institute of Network Coding
and
Institute of Theoretical Computer Science and Communications
Seminar

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The Capacity Region of the Two-Receiver MIMO Broadcast Channel with Private and Common Messages
by
Prof. Chandra Nair
The Chinese University of Hong Kong

Date	**:**	**14 August 2012 (Tuesday)**
Time	**:**	**2:30 - 4:40 pm**
Venue	**:**	**Room 833 , Ho Sin Hang Engineering Building**
		The Chinese University of Hong Kong

Remark: This will be a technical tutorial (whiteboard) and the title is misleading, i.e. the focus will not be on MIMO channels but on a new method to show optimality of Gaussian distributions in certain non-convex optimization problems that arise in information theory.

<u>Abstract</u>

The capacity region of MIMO (or vector Gaussian) broadcast channel has been of considerable interest to the information theory community over the past 15 years or so. There has been some remarkable progress with a temporary peak (in 2005/2006) when the capacity region of the MIMO broadcast channel with private messages was obtained by Weingarten, Steinberg, and Shamai (which, btw, obtained the best paper award in IT) through a tour-de-optimization using ideas like channel enhancement, dirty paper coding, etc. However the extension of the results to the case with both private and common messages remained open though several serious attempts have been made to make progress on this problem. A few months ago, we accidentally managed to solve this open problem. It was a consequence of several new ideas from the discrete world and the techniques are very different from the earlier methods in the Gaussian landscape. We developed a new way of showing the optimality of a Gaussian distribution in certain optimization problems, which allows one to bypass the use of Entropy Power Inequality (the only previously known technique in such settings). Using this new technique, we re-derive several of the existing results in a new and simpler way. Further to show the power of the new technique, we also solve the open problem and settle the capacity region of the two - receiver MIMO broadcast channel with private and common messages.

This technique surely has much more potential and hence I thought it may be probably proper to give a longish tutorial on the various ideas involved.

This will be a technical talk and the audience will be assumed to have some background in information theory and probability theory. Indeed, I plan to have two parts to the talk; in the first part I will try to keep it less sophisticated while in the second part, I will go into some technical nuances that one needs to be be aware of (and also to show that i's were dotted and t's were crossed).

This is joint work with my student, Yanlin Geng.

<u>Biography</u>

Prof. Nair did his undergraduate studies at the Indian Institute of Technology (IIT), Madras in electrical engineering graduating in 1999. He received the Siemens and Phillips (India) medal for having the best academic record in the department during his undergraduate studies. Concurrently, he also completed the four year nurture programme in Mathematics at the Institute of Mathematical Sciences (IMSc) under the auspices of the National Board of Higher Mathematics(NBHM).

He received a Masters (2002) and PhD (2005) in electrical engineering from Stanford University. He was a Stanford Graduate Fellow (2000-2004) and then a Microsoft Graduate Fellow (2004-2005) during his graduate studies. Then he became a postdoctoral fellow at prestigious theory group in Microsoft Research for two years. Following this he joined the IE department faculty, CUHK, in Fall 2007.

His current interests are in basic network information theory problems, in particular the broadcast channel. He has previously worked on problems touching many areas including combinatorial optimization, statistical physics, algorithms, and networks.

**ALL ARE WELCOME **