

## Large System Analysis of the Energy Consumption Distribution in Multi-User MIMO Systems with Mobility

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**Room: BAR I 15**

**Abstract:** In this work, we consider the downlink of a single-cell multi-user MIMO system in which the base station (BS) makes use of  $N$  antennas to communicate with  $K$  single-antenna user equipments (UEs). The UEs move around in the cell according to a random walk mobility model. We aim at determining the energy consumption distribution when different linear precoding techniques are used at the BS to guarantee target rates within a finite time interval  $T$ . The analysis is conducted in the asymptotic regime where  $N$  and  $K$  grow large with fixed ratio. Both recent and standard results from large system analysis are used to provide concise formulae for the asymptotic transmit powers and beamforming vectors for all considered schemes. These results are eventually used to provide a deterministic approximation of the energy consumption and to study its fluctuations around this value in the form of a central limit theorem. Closed-form expressions for the asymptotic means and variances are given. Numerical results are used to validate the accuracy of the theoretical results and to make comparisons. We show how the results can be used to approximate the probability that a battery-powered BS runs out of energy and also to design the cell radius for minimizing the energy consumption per unit area.

**Bio:** Luca Sanguinetti is an Assistant Professor in the Dipartimento di Ingegneria dell'Informazione of the University of Pisa. He received the Telecommunications Engineer degree (cum laude) and the Ph.D. degree in information engineering from the University of Pisa, Italy, in 2002 and 2005, respectively. Since 2005 I have been with the Dipartimento di Ingegneria dell'Informazione of the University of Pisa. In 2004, he was a visiting Ph.D. student at the German Aerospace Center (DLR), Oberpfaffenhofen, Germany. During the period June 2007 - 2008, he was a postdoctoral associate in the Department of Electrical Engineering at Princeton. During the period June 2010 - Sept. 2010, he was selected for a research assistantship through the DAAD STIBET funding at the Technische Universitat Munchen. Since July 2013, he is a sabbatical researcher in the Large Networks and Systems Group of Centrale-Supelec. He is currently serving as an Associate Editor for IEEE Trans. Wireless Commun. He was the co-recipient of the Best Paper Awards at the 2013 and 2014 International Conference on Wireless Communications and Networking Conference (WCNC) and the recipient of the FP7 Marie Curie International European Fellowships for career development (IEF) 2013 Dense4Green "Dense deployments for green cellular networks". His expertise and general interests span the areas of wireless communications and signal processing. Current research topics focus on dense deployments for green cellular networks and on interference management in heterogenous networks via large system analysis.