



**THE CHINESE UNIVERSITY OF HONG KONG**  
Department of Information Engineering  
*Seminar*

**The Necessity of Scheduling in Compute-and-Forward**  
by  
**Mr. Ori Shmuel**  
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**Date : 3 Nov., 2017 (Fri.)**  
**Time : 3:30pm – 4:30pm**  
**Venue : Room 833, Ho Sin Hang Engineering Building**  
**The Chinese University of Hong Kong**

*Abstract*

Compute and Forward (CF) is a promising relaying scheme which, instead of decoding single messages or forwarding/amplifying information at the relay, decodes linear combinations of the simultaneously transmitted messages. By doing so, instead of combating the interference and noise at the relay, it combats only the noise, and relays clean linear combinations of messages, which are easy to decode at the destination by simple matrix inversion. The current literature includes several coding schemes and results on the degrees of freedom in CF, yet for systems with a fixed number of transmitters and receivers. It is unclear, however, how CF behaves at the limit of a large number of transmitters and fixed power.

In this work, we investigate the performance of CF in that regime. Specifically, we show that as the number of transmitters grows, CF becomes degenerated, in the sense that a relay prefers to decode only one (strongest) user instead of any other linear combination of the transmitted codewords, treating the other users as noise. This, of course, results in poor performance, and the sum-rate tends to zero. Consequently, scheduling is necessary in order to maintain the superior capabilities CF may provide. Indeed, under scheduling, we show that non-trivial linear combinations are chosen, and the sum-rate does not decay, even without state information at the transmitters and without interference alignment.

*Biography*

Ori Shmuel received his B.Sc. and M.S. degrees in Communication Systems Engineering from Ben Gurion University of the Negev, Israel, with honors, at 2014 and 2016, respectively. He is now a Ph.D. student. During his undergraduate studies, he received the university's Rector prize for excellence in studies. His research interests are information theory and communications, with an emphasis on scheduling, coding and queuing.

**\*\* ALL ARE WELCOME \*\***