

## Department of Electrical and Computer Engineering

Title: « **Directed information and its application in communication, economics and statistical physics** »

**Professor Haim Permuter**

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**Friday**, 25<sup>th</sup> September 2015, 17:00 – 18:00  
Room ΠΤΕΡ – E010, Old Campus – University of Cyprus

### **Abstract:**

In this talk we will present a fundamental role that directed information and causal conditioning has in communication with feedback, gambling with causal side information, causal MMSE estimation, statistical physics, and causal inference between two processes.

We will begin by defining and establishing some key properties of the notions of causal conditioning and directed information. These properties will be seen to be natural counterparts, for the case where feedback is present, of the well-known properties of regular conditioning and mutual information.

Applications of these multi-letter capacity expressions will be discussed. In particular we will show a framework for the computation of capacity of unifilar channels. We will also detail how the framework can lead to closed form analytical solutions, such as in the case of the trapdoor/chemical channel, the Ising channel and erasure channel with no two consecutive ones.

We will discuss recent application of directed information and causal conditioning in fields other than communication such as horse-race gambling, stock investment with causal side information, a relation between causal MMSE estimation and directed information, extraction of energy using casual information from systems like Szilard engine, and, finally, we will present how to measure causal dependency between sequences using the directed information.

### **Biography:**

Haim Permuter received his B.Sc. (summa cum laude) from Ben-Gurion University (BGU) and Ph.D. from Stanford University, both in Electrical Engineering, in 1997 and 2008, respectively. Between 1997-2004, he served as a scientific research officer in an R&D unit in the Israeli Defense Forces. In summer 2002 he worked for IBM, Almaden research center. He is a recipient of several rewards including Eshkol Fellowship, Wolf Award, Fulbright Fellowship, Stanford Graduate Fellowship, Allon Fellowship and ERC starting grant. Haim joined the faculty of Electrical Engineering Department at BGU in Oct 2008, and is now an associate professor. He currently serves as an associate editor for the IEEE transaction on Information Theory.