

## **Analysis of D2D Underlaid Cellular Networks: SIR Meta Distribution and Mean Local Delay**

### **Abstract:**

We study the performance of device-to-device (D2D) communication underlying cellular wireless network in terms of the meta distribution of the signal-to-interference ratio (SIR), which is the distribution of the conditional SIR distribution given the locations of the wireless nodes. Modeling D2D transmitters and base stations as Poisson point processes (PPPs), moments of the conditional SIR distribution are derived in order to calculate analytical expressions for the meta distribution and the mean local delay of the typical D2D receiver and cellular downlink user. It turns out that for D2D users, the total interference from the D2D interferers and base stations is equal in distribution to that of a single PPP, while for downlink users, the effect of the interference from the D2D network is more complicated. We also derive the region of transmit probabilities for the D2D users and base stations that result in a finite mean local delay and give a simple inner bound on that region. Finally, the impact of increasing the base station density on the mean local delay, the meta distribution, and the density of users reliably served is investigated with numerical results.