

A THz Network: A Juvenile Technology Promising Grand

Abstract:

Terahertz (THz) frequencies are very likely going to be used for a near-future next generation network. Contrasting with 4G and 5G networks, using low and high GHz frequencies, the THz part of the spectrum inherently enables features such as ultrahigh bandwidth, ultralow latency and brings ideas like ultralow power consumption through energy harvesting closer by. In this talk, I explain the aspects of THz technology relevant for a THz network and will shine light on foreseen novel use cases for society and industry.

THz radiation by itself is intriguing, as it behaves both like high frequency radio waves, but also like optical radiation such as infrared and visible light: it penetrates only through some materials such as clothes, but not through walls, and it does not bend around buildings since it is much more directed than MHz and GHz frequencies. This creates possibilities for e.g. new (cell-less) network architectures and inherently reduces possibilities of eavesdropping, but also poses difficulties in that nodes need to be more in a line of sight, and at shorter distances. THz technology, however, is very new and only existing since the late 1990s. The industrialization of broadband THz radiation started about a decade ago with ABB, applying it for the first time to multiple industrial sectors such as the automotive, semiconductor and paper industries. The obtained success was largely due to revolutionary signal processing: a powerful algorithm that universally applies to sensing applications, and which provides a realm of material properties.

The implementation of THz radiation for future networks will have major consequences for its application for other societal uses, e.g. in the areas of sensing, medicine and security. It would be easily imaginable that those new use cases become intertwined with its telecommunication purpose, such that a communication device also enables e.g. food quality inspection and early medical diagnosis. These new markets where THz radiation is applied for vast societal purposes, are currently hampered by the cost tag that exceeds 50 kUSD for its generation and detection. A THz network will require the maturation of inherently cheaper electronic THz technologies, which by itself and through mass production will dramatically decrease the costs. With all its foreseen advantages, a THz-based network will have a huge implication for society, and large industrial engineering groups, such as ABB, play an important role in realizing this.