

Extreme Sub-wavelength Electromagnetic On-chip Antenna

There is a great demand for on-chip antennas that can communicate between the electronics on a chip and the outside world via electromagnetic (EM) or acoustic waves. Unfortunately, most antennas need physical dimensions that are comparable to the wavelength of the EM or acoustic wave. Because of this, only sub-wavelength antennas can be put on a chip. Acoustic antennas radiate acoustic waves unlike EM antennas, which radiate EM waves. Acoustic antennas are less preferable than EM antennas since acoustic waves need a solid medium to propagate through and the speed of the signal propagation is about five orders of magnitude slower than EM signal propagation. However, the advantage of acoustic antennas is that the wavelength of acoustic waves at 100 MHz is only about 30 μm , which allows it to be integrated on a chip. Modern communication systems will benefit immensely if antenna dimensions can be reduced to small fractions of the emitting wavelength.

The technology

An inventor at Virginia Commonwealth University has developed an extreme sub-wavelength EM antenna with a surface acoustic wave (SAW) whose wavelength is about five orders of magnitude smaller than the EM wavelength at the same frequency. This extreme sub-wavelength antenna consists of an array of magnetostrictive nanomagnets fabricated on a piezoelectric substrate which allows for drastic miniaturization of communication systems; because they radiate with efficiencies of a few orders of magnitude larger than the A/λ^2 limit. In order to overcome this limit, the EM antenna was excited at acoustic resonance instead of EM resonance. This antenna has been tested up to 35GHz with effective gain and radiation efficiency.

Benefits

- » Can act as both an acoustic and EM antenna
- » Antenna dimensions can be a few hundred nanometers
- » Low irradiated power

Applications

- » Downscaling communication systems
- » New high frequency applications
- » 5G communications

Patent status:

Patent pending: U.S. and foreign rights are available.

License status:

This technology is available for licensing to industry for further development and commercialization.

Category:

Engineering and Physical Science

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