Researchers boost wireless power transfer with magnetic field enhancement

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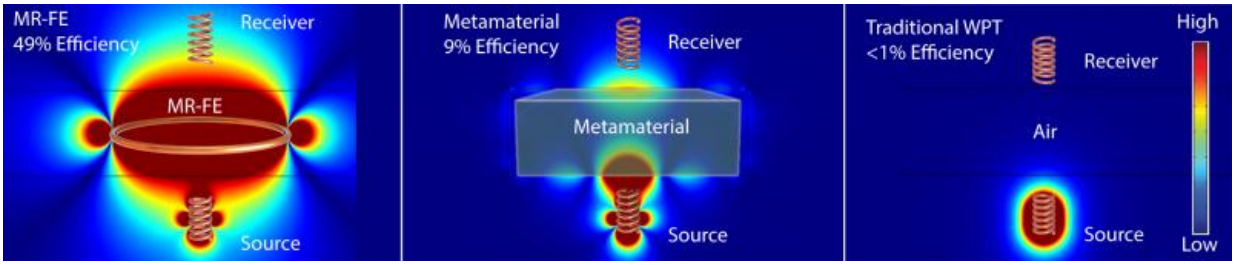

From left to right: performance of wireless power transfer using an MRFE, a metamaterial, and through air alone.

Research from North Carolina State University and Carnegie Mellon University shows that passing wireless power transfer through a magnetic resonance field enhancer (MRFE) – which can be as simple as a copper loop – can boost the transfer efficiency by at least 100 percent as compared to transferring through air alone. MRFE use could potentially boost transfer efficiency by as much as 5,000 percent in some systems, experts say.

Wireless power transfer works by having a transmitter coil generate a magnetic field; a receiver coil then draws energy from that magnetic field. One of the major roadblocks for development of marketable wireless power transfer technologies is achieving high efficiency.

"Our experimental results show double the efficiency using the MRFE in comparison to air alone," says David Ricketts, an associate professor of electrical and computer engineering at NC State and corresponding author of a paper describing the work.

Enhancing wireless power efficiency has been a major goal of many research groups. One of the leading candidates proposed for enhancing efficiency has been a technology called metamaterials. "We performed a comprehensive analysis using computer models of wireless power systems and found that MRFE could ultimately be five times more efficient than use of metamaterials and 50 times more efficient than transmitting through air alone," Ricketts says.

By placing the MRFE between the transmitter and the receiver (without touching either) as an intermediate material, the researchers were able to significantly enhance the magnetic field, increasing its efficiency.

"We realized that any enhancement needs to not only increase the magnetic field the receiver 'sees,' but also not siphon off any of the power being put out by the transmitter," Ricketts says. "The MRFE amplifies the magnetic field while removing very little power from the system."

The researchers conducted an experiment that transmitted power through air alone, through a metamaterial, and through an MRFE made of the same quality material as the metamaterial. The MRFE significantly outperformed both of the others. In addition, the MRFE is less than one-tenth the volume of metamaterial enhancers.

"This could help advance efforts to develop wireless power transfer technologies for use with electric vehicles, in buildings, or in any other application where enhanced efficiency or greater distances are important considerations," Ricketts says.

More information: "Magnetic field enhancement in wireless power using metamaterials magnetic resonant couplers." DOI: 10.1109/LAWP.2015.2452216

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