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More efficient wireless power transfer possible with hemispherical coils

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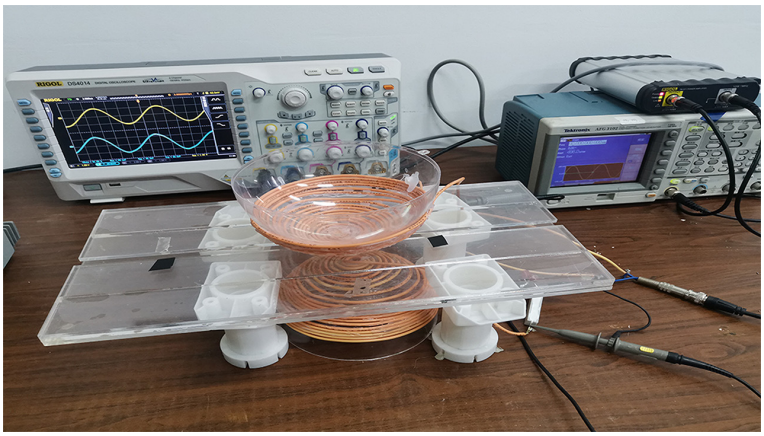
Alternatively shaped coils circumvent frequency splitting in wireless power transfer.



Two adjacent wire coils can transfer energy via inductive coupling to facilitate wireless charging. This technology is widely used in smartphone and household electronics, in certain medical devices like implanted pacemakers, and in some electric vehicles. One of the drawbacks of wireless power transfer is called frequency splitting: when the wire coils are placed too close together, the load voltage, and by extension, the resonant frequency, splits into two peaks and reduces the efficiency of the system.

Niu et al. proposed an alternate shape for wireless power transfer, featuring hemispherical coils instead of traditional flat coils. This arrangement solves the frequency splitting problem, improves efficiency, and promotes more stable coupling.

The team examined two similar arrangements, one with a hemispherical coil paired with a flat coil, and one with two hemispherical coils paired together. In both cases, the arrangement effectively reduced the frequency splitting effect.

The hemispherical coil designs had several benefits in addition to reducing frequency splitting, such as a better tolerance for angular misalignment and more flexibility.

“In applications such as electric vehicles, electric boats, and implantable medical electronic devices where the coil volume is not an issue, control costs such as frequency tracking can be reduced with this design,” said author Jiateng Jiang. “In addition, the hemispherical coil can suppress frequency splitting within a larger transfer distance, has a higher transfer efficiency, and is more versatile.”

The researchers plan to test their designs with higher voltages and in different conditions, including underwater.

Source: “Frequency splitting suppression in wireless power transfer using hemispherical spiral coils,” by Wangqiang Niu, Jiateng Jiang, Chen Ye, and Wei Gu, *AIP Advances* (2022). The article can be accessed at https://doi.org/10.1063/5.0078744.

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