



Inductive wireless power transmission

Abstract:

Wireless power transmission is known since more than a century, but recently it got more and more attention, because users demand wireless operation for a growing number of applications. Cheap power electronics at suitable operating frequencies are nowadays available and could make those wishes possible. However, the design of such a system is not always straight forward, and engineers are facing a number of issues they didn't have before.

Therefore, this tutorial is offered to all, who intend to design an inductive wireless power system and to those, who have to decide, whether an application would be possible.

The tutorial covers the following topics:

- *Applications: From Milliwatts to Kilowatts:*
A number of examples for wireless power applications will be presented ranging from small mobile devices to electric vehicle charging. These will be existing products and examples from R&D.
- *Resonant power transmission:*
It will be discussed, what the real benefit of resonant operation is. The differences of resonances on the transmitter and the receiver side and parallel and series resonant operation will be investigated. Based on this, the influence on power transfer, losses, efficiency and control will be explained.
- *Limits of inductive power transmission:*
The wireless power transfer is limited by several parameters. Here, the limits which are determined by efficiency and by magnetic emissions will be determined.
- *Free positioning of receivers:*
Many wireless power applications benefit from a free placement of a power receiver. Suitable coil arrangements and winding designs will be presented.
- *Design of transmitter and receiver inductors:*
The quality factor of the transmitter and receiver coils is a crucial parameter for an efficient wireless power system. However, at higher operating frequencies AC losses significantly deteriorate the coil properties. The losses can be minimized by an optimized design, which will be shown for wire-wound and printed circuit board inductors.
- *The Wireless Power Consortium and the Qi standard for mobile devices*
In 2010 the Wireless Power Consortium released the first worldwide inductive wireless power standard for mobile devices named Qi. Details of this standard including operating frequency, power control, device detection, and communication format will be explained.

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Instructor Bio:

Eberhard Waffenschmidt studied electronics at the Technical University (RWTH) in Aachen, where he received his PhD degree. Since 1995 he is employed at Philips Research Aachen, now as senior scientist. He is Senior Member of the IEEE since 2010. He specialized himself on magnetic devices and passive integrated components for power

applications. Since some years his special interest is on wireless power transmission. Inspired by his work, Philips founded the international Wireless Power Consortium, which released the first worldwide industry standard for the wireless charging of mobile devices in 2010.