Inductive Power Transmission

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The basic principle of an inductively coupled power transfer system is shown in Figure 1. It consist of a transmitter coil L1 and a receiver coil L2. Both coils form a system of magnetically coupled inductors. An alternating current in the transmitter coil generates a magnetic field which induces a voltage in the receiver coil. This voltage can be used to power a mobile device or charge a battery.

The efficiency of the power transfer depends on the coupling (k) between the inductors and their quality (Q). (See also Figure of merit)

The coupling is determined by the distance between the inductors (z) and the relative size (D2 /D). The coupling is further determined by the shape of the coils and the angle between them (not shown).

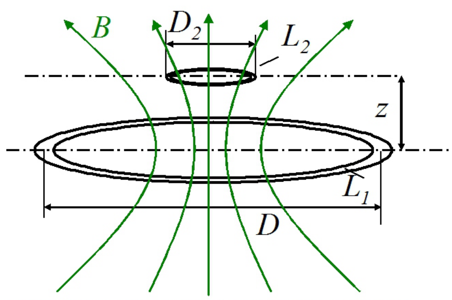

Figure 1 Typical arrangement of an inductively coupled power transfer system

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Transfer efficiency

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Figure 2 shows the calculated optimal achievable efficiency of a system according to Figure 1 with the assumption of a quality factor of 100. All dimensions are scaled to the diameter of the larger coil D, which ever it is (transmitter or receiver coil).

The values are shown as a function of the axial distance of the coils (z/D). The parameter is the diameter of the smaller coil D2.

The figure shows that

- The efficiency drops dramatically at larger distance (z/D > 1) or at a large size difference of the coil (D2/D < 0.3)
- A high efficiency (>90%) can be achieved at close distance (z/D < 0.1) and for coils of similar size (D2/D = 0.5..1)

This shows that inductive power transmission over a large distance, e.g. into a space, is very inefficient. Today, we cannot afford to waste energy for general power applications by using such a system.

On the other hand, the figure shows that inductive power transmission in the proximity of the devices, e.g. at a surface, can be really efficient and competitive to wired solutions. Wireless proximity power transmission combines comfort and ease of use with today's requirements for energy saving.

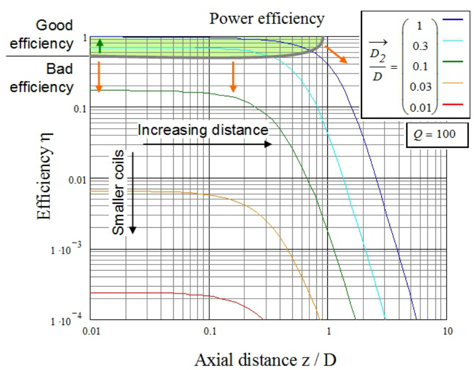

Figure 2 Power efficiency for an inductive power transfer system consisting of loop inductors in dependence on their axial distance z with size ratio as parameter. Calculated for a quality factor of Q = 100

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