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ANALYTICAL AND NUMERICAL EVALUATION OF THE EFFICIENCY OF A LOW POWER WPT SYSTEM

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There is an increase in energy demand in mobile devices. Their computing power and the number of supported sensors are constantly growing. These factors result in an increased demand for batteries with higher capacity, extending their charging time.
One way to power mobile devices is to charge them using wireless power transfer (WPT). Thanks to the concept of inductive power transfer (IPT), it is possible, among others, to wirelessly charge modern technology devices (phones, smartphones, laptops). WPT is becoming more and more widely used. Wireless charging is also suitable for lightning hard-to-reach places or intelligent buildings with sensors in the walls. WPT is considered an alternative method of charging wireless devices.
The article presents the results of the numerical and analytical analysis of the WPT system. The system consists of a transmitting and receiving surfaces, each consisting of flat spiral coils. Both proposed approaches reduce the size and complexity of models. Two coil systems were also considered: periodic and with variable winding direction. The difference between the proposed systems is a different way of winding the coils. In the periodic system, all coils are wound in the same direction. The influence of the type of coils, winding direction, number of turns and distance between coils on the efficiency of the WPT system was compared. The analysis covered a wide frequency range from 100 kHz to 1000 kHz. The Finite Element Method (FEM) was used for the analysis. Comparing both systems, models with variable coil winding show higher efficiency values. The proposed system allows for simultaneous charging of many sensors (located e.g. in walls).

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