Phase Angle Analysis of a Wireless Power Supply System

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***Abstract*: The article presents an analysis of two manners of compensating electrical energy transmission systems. Depending on the load resistance and power supply frequency, phase characteristics are shown. Methods of obtaining the highest efficiency of a system are described.**

***Keywords*: wireless power supply, phase angle, resonance.**

I. INTRODUCTION

It is possible to use a wireless technology of electric energy transmission in many devices. In order to construct such a system properly, a series of analyses were carried out of two selected methods of compensating the reactance of a secondary winding coil.

II. COMPENSATION METHOD PHASE ANALYSIS

The article presents the phase characteristics of wireless electrical energy transmission systems[1]. Two types of air-core transformer systems were analysed [2,3], with a series coil and condenser connection used at the side of the power supply, that is at the side of the primary winding. Again, at the secondary side the coil was tested for two types of inductance compensation. Series and parallel compensation was used, with the LC connected in series at the primary side, and the LC connected in parallel at the secondary side. A phase analysis was carried out for the above systems, the variable parameters being the frequency of the system and the load resistance.

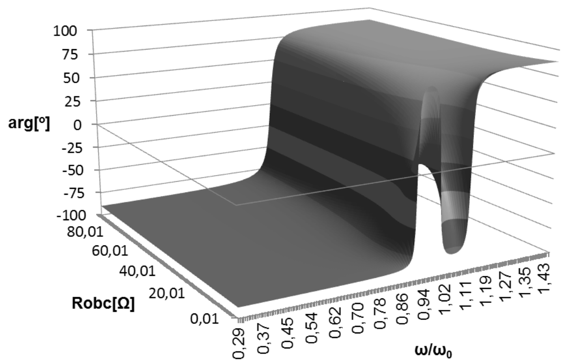

Fig.1. Phase characteristics of the system with series compensation.

A zero angle is the phase angle value required by both systems. Then a system is of a resistance character and has the largest efficiency. The phase angle of the wireless electric power supply system was measured for fixed values of the coil inductance, condenser capacity of the primary and secondary winding, and the coupling of k=0.2.

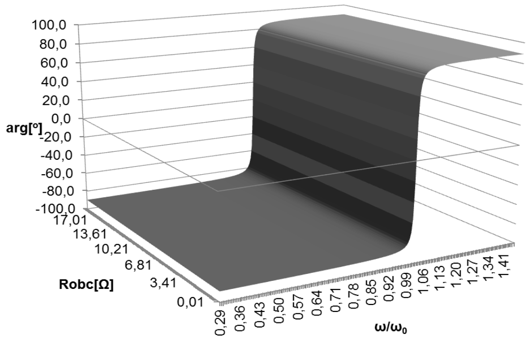

Fig.2. Phase characteristics of the system with parallel compensation.

III. CONCLUSION

With a load resistance of about 0.01 to 10Ω in the series compensation system, fig. 1, the phase angle fluctuates slightly. In this range the system has a resistance character for three different frequencies, but is most efficient only for the resonance frequency. The system has a resistance character only with $\omega/\omega_0=1$ in a further range. In the case of the parallel compensation system, a phase shift occurs not only for one frequency. With this system, fig 2, it is not easy to obtain a resistance character for a resonance frequency set. The required condition is to determine the same resonance frequency for the series LC system (primary side) and for the parallel LC system (secondary side). Not always is this condition fulfilled for a fixed inductance value. In such a case, the resonance of the secondary winding can be obtained by matching the reactance elements or by constructing an adapting system to automatically adjust a power supply frequency to the resonance state of the highest efficiency.

IV. REFERENCES.

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