

The Effect of Retarded Phase Factor in Single Wire Power Transmission

Xiaodong Liu^{1*}, Qichang Liang¹, Yu Liang²

1. Department of Nuclear Physics, China Institute of Atomic Energy, P.O. Box 275(10), Beijing 102413, China

2. Pangeo Corporation, 2005 Black Acre Dr., Oldcastle ON, N0R 1L0, Canada

* Email: liuxiaod@gmail.com

Abstract

In this paper, we studied the effect of retarded phase factor in single wire power transmission. It is indicated that the effective resistance of load is negative when the length of wire is one quarter of wavelength. The loading current acts like a driving source to charge the transmitter so that the oscillating power of transmitter is amplified. It is anticipated that this technology can be used to generate electric power.

Keywords: *single wire power transmission, retarded phase factor, negative resistance*

Introduction

Nikola Tesla invented the technology of single wire power transmission in 1897 [1], which is different to conventional transmission line. Recently we have studied the effect of retarded phase factor in wireless power transmission [2-4]. In this work, we extend our study to single wire power transmission. We find that the effect of retarded phase factor also exists in single wire and it results in an enhanced effect than wireless systems.

Methods

The schematic of single wire power transmission is shown in Fig.1. The transmitter on the left is composed of a power source V and a transformer T_1 . The receiver on the right is composed of a transformer T_2 and a load R_L . The length of wire is D .

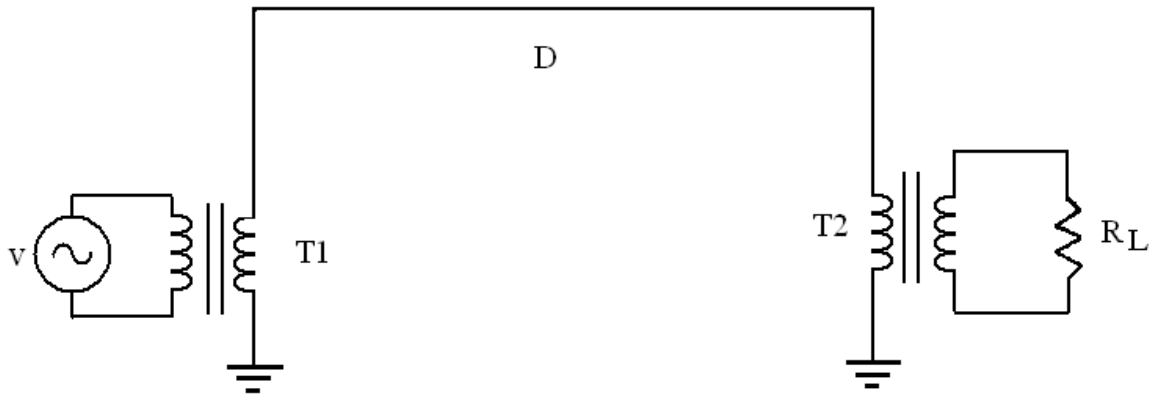


Figure 1: Schematic of single wire power transmission.

The driving voltage propagates along the wire via the wave of electric density. Due to retardation on the wire, the driving voltage on T_1 and T_2 has the relation of

$$U_2(t) = U_1(t) \cdot \psi \quad (1)$$

where $U_1(t)$ and $U_2(t)$ is the driving voltage on T_1 and T_2 respectively and ψ is the retarded phase factor:

$$\psi = e^{-i2\pi \frac{D}{\lambda}} \quad (2)$$

The current in T_2 is

$$I_2(t) = \frac{U_2}{R_L} \quad (3)$$

The current in T_1 is

$$I_1(t) = I_2(t) \cdot \psi = \frac{U_1}{R_L} \cdot \psi \cdot \psi \quad (4)$$

The effective resistance on T_1 is

$$R_1 = \frac{R_L}{\psi \cdot \psi} \quad (5)$$

When the length D is short, $\psi \approx 1.0$, we have $R_1 = R_L$. When the length D is equal to one quarter of wavelength, $\psi = -1.0i$, we have $R_1 = -R_L$. The effective resistance of load seen from the power source is negative. In this case, the phase of $I_1(t)$ is inverted relative to the phase of $U_1(t)$ and the electric power would flow into instead of out of the source.

Conclusion

In a single wire power transmission system, the current and voltage propagate along the wire via the wave of electric density. The effective resistance of load is negative when the wire length is $\frac{1}{4}$ of wavelength. In this case, the loading current acts like a driving source to charge the transmitter. This technology can be used in the field of electric power generation.

Acknowledgment

Special thanks to Mrs. Yulan Yao, Mr. Jian Liang, and Mr. Fengjun Zang for their encouragements and financial support to this work.

References

- [1] Nikola Tesla, US Patent No. 593138 (1897)
- [2] Xiaodong Liu, Qichang Liang, Yu Liang, *The Retarded Phase Factor in Wireless Power Transmission*, July 2011, <http://www.vixra.org/abs/1107.0029>
- [3] Qichang Liang, Yu Liang, Xiaodong Liu, *Energy Multiplier in Retarded Resonance*, April 2011, <http://www.vixra.org/pdf/1104.0052v1.pdf>
- [4] Qichang Liang, Yu Liang, Xiaodong Liu, *The Retarded Energy Transmission in Remote Resonance*, Sciencepaper Online, No. 200908-176, August 2009, <http://www.paper.edu.cn/index.php/default/releasepaper/downPaper/200908-176>