The Measurement of Retarded Phase In Single Wire Power Transmission

Xiaodong Liu[1]*, Qichang Liang[1], Yu Liang[2]

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 work, we measured the retarded phase in single wire power transmission. It is verified that the retarded phase is dependent on frequency. When the value of retarded phase is 180˚, the current through the power source is phase inverted relative to its voltage so that the effective resistance of load is negative. This phenomenon needs to be investigated further for the usage of electric power generation.

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

Introduction

Recently we predicted that the effect of retarded phase exists in single wire power transmission [1] as well as in wireless power transmission systems [2,3,4]. In this work, we performed experimental measurement for the retarded phase in single wire transmission and verified that our prediction is correct.

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 (MADELL CA 1640-20), a transformer T_1, and a resistor R_1. The value of R_1 is 1.0 ohm. The receiver on the right is composed of a transformer T_2 and a load resistor R_L. The value of R_L is 10.0 ohm. The single wire D is one of 20 Awg magnet wire and its length is 32.6 meter.

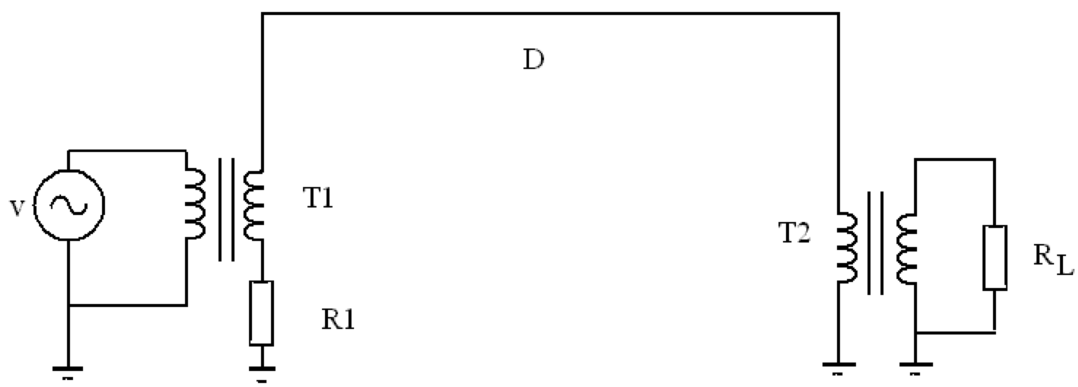

Figure 1: Schematic of single wire power transmission.

We measured the output voltage of the source V and the voltage V_{R1} on the resistor R1. As shown in Fig. 2, the output voltage of source decreases in higher frequency. The data of V_{R1} is shown in Fig. 3. It presents a periodic distribution versus the frequency. The data between 4.4 MHz and 7.6 MHz were not available due to irregular wave shapes.

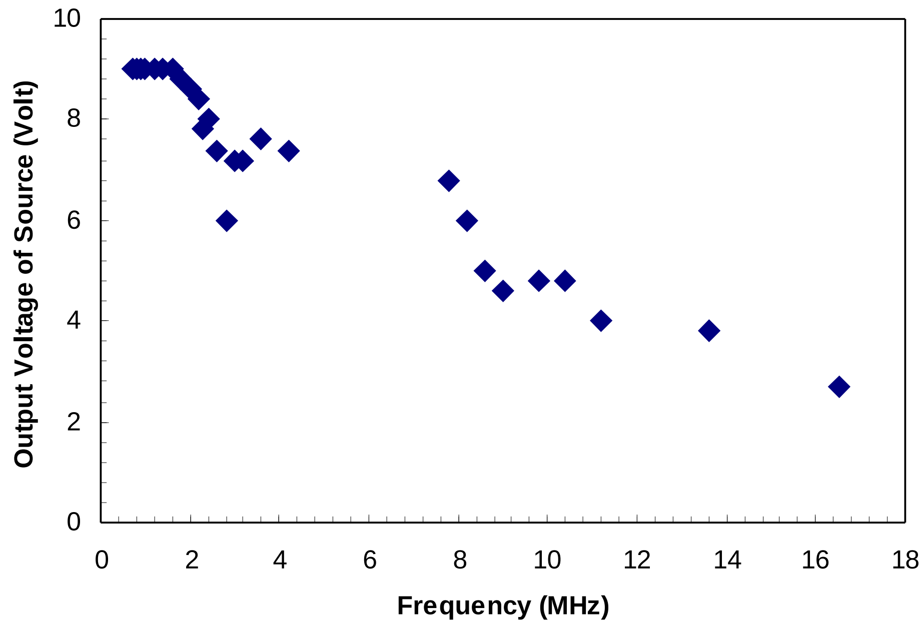

Figure 2: The output voltage of source versus frequency.

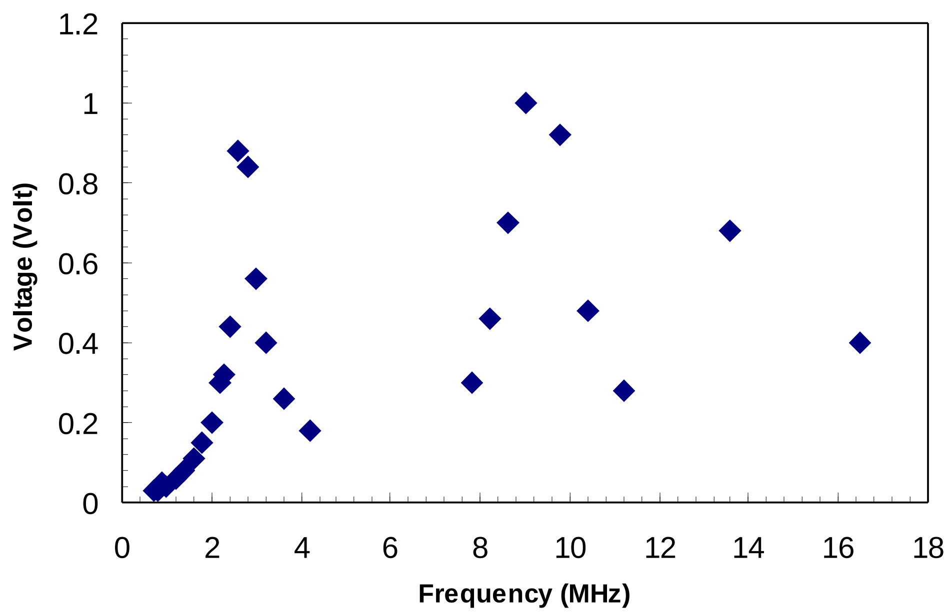

Figure 3: The voltage on resistor R_1 versus frequency.

The phase difference between V and V_{R1} is shown in Fig. 4. It is obviously that the retarded phase of current through R_1 presents a periodic distribution versus frequency. The retarded phases around 2.0 MHz and 8.0 MHz are close to 180˚. The retarded phases around 4.0 MHz and 11.0 MHz are close to zero. The retarded phases at 9.0 MHz and 13.6 MHz are close to 90˚.

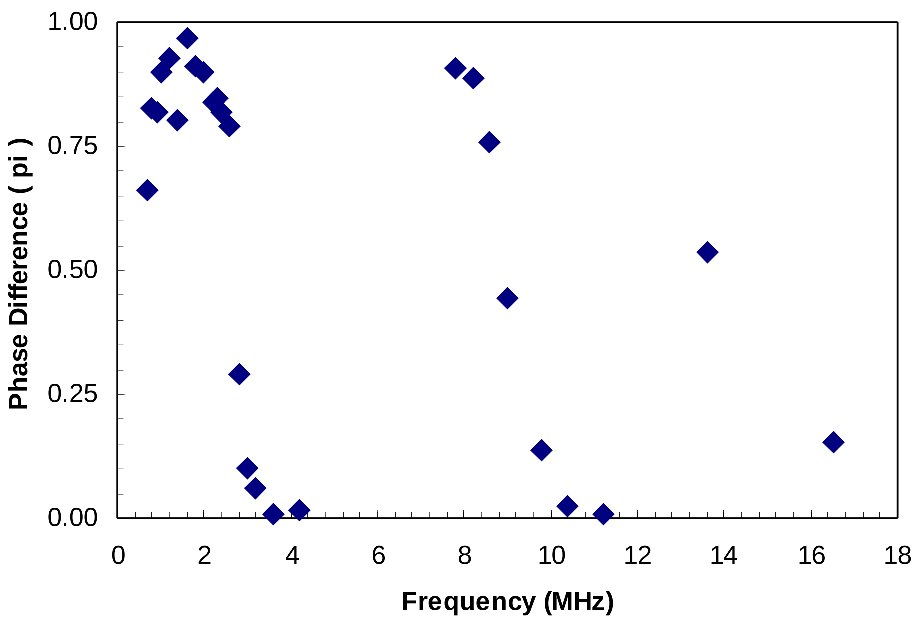

Figure 4: The measured retarded phase versus frequency.

Discussion

When the current is phase inverted relative to the voltage, the effective resistance of load resistor is negative. In this case, the current acts like to charge the source. This is the first time to achieve negative resistance. It is anticipated that this technology can be used to generate electric power.

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