# A Measurement Method of Fast Voltage Rise Curves due to Gap Discharge Using Coupled Transmission Lines in Distributed Constant Line System

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Abstract

The measurement method of very fast voltage transients due to gap discharge using coupled transmission lines was examined to find the pure voltage rise curves. The measurement system consists of the distributed constant line system, because the voltage transients were very rapid. A characteristic of the gap electrode, which has a matched impedance for the distributed constant system, was investigated in the frequency range below 5 GHz. The voltage of power source in experiment was 510 V and 800 V because the Paschen's law holds stability in air condition. As a consequence of the experiment using this measurement system, the measurement method made it possible to observe the rise time of about 100 ps. It was confirmed that the measurement method enables to measure the high speed and high voltage rise curves out of contact with the main circuit. And so, the voltage rise times were varied in accordance with the voltage.

***Keywords***: measurent method, voltage rise curve, coupled transmission lines

## I. INTRODUCTION

It is well known that the sudden voltage transients are generated at the make and break of electrical contacts and surrounding electrical devices are affected. The discharge at the contacts should be considered as a main factor of the electromagnetic noise source[1),2)]. Switching noise has been studied extensively, but in almost all reports, phenomena at the electric contacts have been investigated from the viewpoint of the contact reliability and the contact materials[3)~8)].

The voltage transients are considered from viewpoint of time domain as EMI source at the making of electrical contacts. However, As the transients were very rapid and fluctuation was complicated, it was difficult to find the factors of the transients due to discharge on lumped constant system[9),10)].

A measurement system of very fast voltage rise curve using coupled transmission lines was examined to find the pure voltage transients. A characteristic of the gap electrode, which has a matched impedance for the distributed constant system, was investigated in the frequency range below 5 GHz. The voltage of power source in experiment was 510 V and 800 V because

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