NISM OF MICROWAVE ABSORPTION
MEMBRANES

Julia F.Korosteleva

artment
University
ow Russia

the experimental fact that
superionic conductivity
On the other hand it was shown
,1975] that materials with
acteristic features in microwave
hat one can expect the same
n biological membranes. These
e in active part of dielectric
ative values accompanied by an
nductivity.
spectra features let us suppose
conductivity is the jump one and

It is evident that this time is
period time.
duced by moving charges will not
current as it has been considered
onent will bring the additional
se the biological response of

ctive current components may be
vity and conductivity of some

comes through trancit time.
ffered absorption mechanism the
th experimental measurements in
rements exist. As an example for
bones dielectric permitivity and
s shown that there is a good
s and measurements.

"A TRANSPORTABLE 500 kV/0.9 ns-RISE TIME NEMP GENERATOR"

by W. Pont
TNO Physics and Electronics Laboratory
P.O. Box 96864, 2509 JG The Hague, The Netherlands

INTRODUCTION

To simulate a Nuclear EMP corresponding to the new demands, a pulser must be able to generate a pulse with a very short rise time corresponding to frequencies in the Giga Hertz region within the working volume of the NEMP simulator. In order to do so, the pulser should have very small dimensions, and act more or less like a point source. Otherwise non-TEM modes are already exited by the pulser itself.
The described generator therefore has cross-sectional dimensions of only 10 cm at the connection of the switch with the wave launcher. The oil-filled fast output circuit furthermore consists of a strip-line capacitor and a SF6-pressurized rail-gap switch.
This fast pulse circuit is driven by a 500 kV/5 ns rise time pulse generator. A 20 feet, non-metallic, container houses the whole generator system.

Constructing such very fast generators learns that there are many limitations, such as minimum dimensions, insulation, series inductance and speed of the switch. So each part of the system must be designed very carefully, nearly up to the limits of what is physically possible.
The described fast circuit has been made in a strip-line structure from the beginning to the end. Figure 1 explains this.

To match the 90 Ω wave launcher to the generator, the characteristic impedance of the strip-line structure is kept 90 Ω constant up to the output electrode of the switch. The input eléctrode is connected to the strip-line capacitor via a very short, low inductance conductor.
The rise time of the generated pulse depends strongly on the fast circuit inductance, the characteristics of the output switch, the way of driving the circuit, and the quality of the output transition.

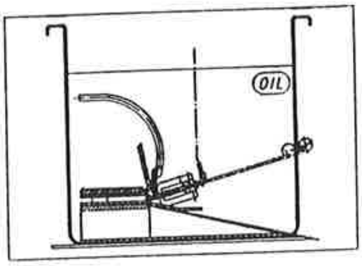


Fig. 1: Fast pulse circuit in strip-line structure.

THE SWITCH

An elliptical curved, 6 cm wide stainless steel rail-gap in SF6, in self breakdown mode, was chosen. The actual closing of this output switch is determined by two mechanisms:
a) *Statistical time-lag.* This is the time needed to form a free electron in the gap volume.
b) *Formative time-lag.* This is the time to build up the discharge current to its maximum value.

These time-lags can be decreased considerably by operating the switch under over-voltage conditions, by driving the circuit with a 5 ns-rise time pulse generator (type 8080 of Physics International Company) via a resistor. For a short time this stressing voltage can be much higher than the static breakdown voltage of the gap.
The rise time related to the switch can be calculated from:

$$t_{gap} = 2.2 \cdot 88 \left(\frac{\rho}{\rho_0}\right)^{1/2} \cdot (Z_c + Z_l)^{-1/3} \cdot E^{-4/3} \qquad [\text{ns}]$$

Where ρ/ρ_0 is the ratio of the SF6-gas density to that of air, E is the electric field in the gap in MV/m, $Z_c + Z_l$ is the total circuit impedance. For a single gap (0.9 cm at 10 bar of SF6) and a voltage of 500 kV, the rise time calculated from the upper equation is 0.56 ns. For a total rise time of 0.9 ns, the inductance-related rise time must be not larger than 0.7 ns. This means that the total circuit inductance must be equal or less than 30 nH; this can only be realized in a coaxial structure. Therefore the strip-line shape has been chosen. For a further decrease of this inductance the rail-gap principle was applied. By applying the charging voltage, of the strip-line capacitor, to the same point where the switch is connected, some time is saved by pre-stressing the gap.

THE STRIP-LINE CAPACITOR

It is formed by aluminium ground and top plates, with a specially shaped[1] centre conductor plate insulated by two plates of dielectric material. Considered as a piece of transmission line, the output-pulse amplitude depends on the characteristic impedance Z_c of this line. The lower Z_c, the higher the pulse amplitude, because of the higher reflection coefficient, when the charged strip-line is switched to the load Z_l (90 Ω), see also figure 2. For a low Z_c the dielectric insulator must have a high ε and must be thin and/or the line must have a large width. These data are in contradiction with high voltage insulation and speed. So, eventually 1.2 cm thick polythene was chosen with a moderate ε_r (2.35) but with a very low loss for high frequencies ($tg\delta = 0.0001$) and high dielectric strength (700 kV/cm). A sandwich construction was used to half Z_c to about 4 Ω.

Once the switch closes, nearly 92% of the voltage is reflected to the open rear of the strip-line. So a stair-case like output pulse is generated (figure 2), each step having 92% of the amplitude of the previous one, and a length of less than 2 ns. Notice that the pulse duration is a function of the reflection coefficient, and the length of the strip-line. Because the pulse duration of the 8080 driver is much longer than the wanted pulse, the measured output pulse has a longer tail than the calculated pulse (figure 2). This could be improved by pulse compression technics.

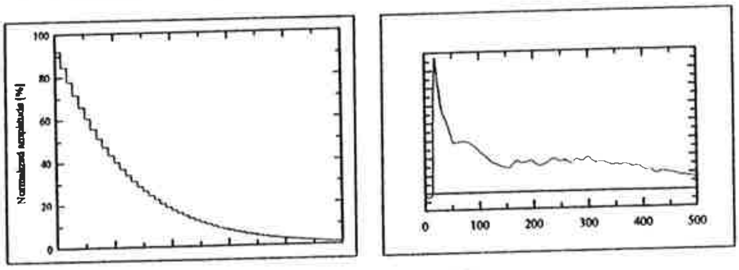


Fig. 2: The generated output pulse; calculated 1) and measured 2).

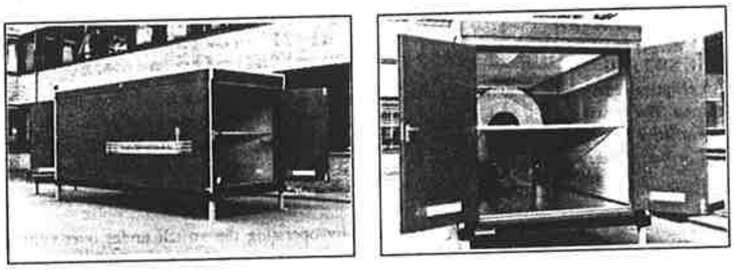


Fig. 3: The complete generator installed in a transportable non-metallic container.

---

1) The plate forms about half a circle, to have equal travelling times, back and forward, of the reflected voltage step to the point the switch input-electrode is connected.

Producing High-Voltag

T.Shiku
Fuji Elect
7, Yawata-kaigandor

Ⅰ.Introduction

Pulsed power sources to generate researches in different fields of generators have been designed wl range of about a few MV and pulse generators are very expensive and of Magnetic Compression explosive advantages, because they are ec weight. In this paper, more empha MC-generators to provide the pulse The MC-generators are usually low a wide variety of low impedance l could take advantage of the posit conditioning systems were availabl In the earlier researches, some pu for that system. However, such dev generators are used.

In this paper, we show the calcu results of more compact syst produce high voltage-pulses.

Ⅱ.Calculation Circuit

Figure 1 shows the calculation c for high voltage generation. In circuit, initial current flows thr generator inductance and interrup $_{off}$. If SW_{off} and closing switcl is operated, then currer interrupted by SW_{off} , voltage i at entrance of transmission line This induced voltage propagates end of line, the voltage will b twice at the end becaus missmaching.

In our calculation, the interrupter,such as opening switch, and closeing switch is assumed to variable resistance that the resistance changes linealy.

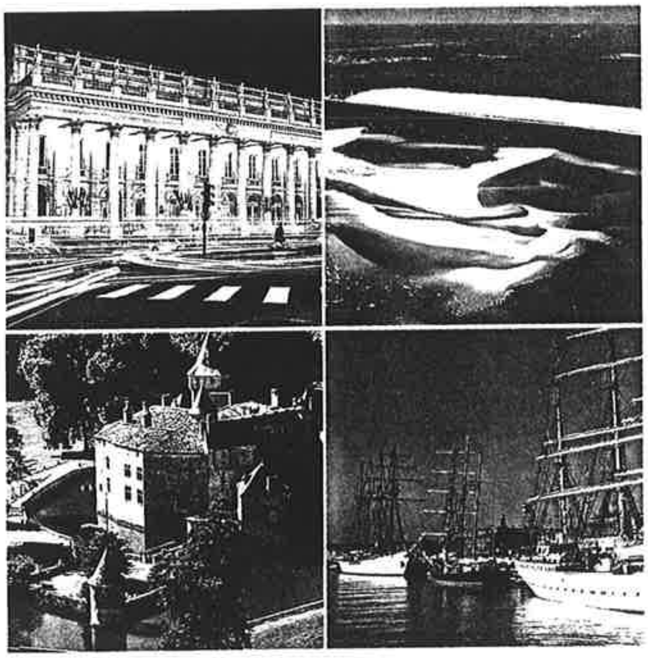
Ⅲ.Results

Figure 2 shows the relationshi between final resistance R_{off} of interrupter and capacitor voltage without T.L.. The output voltage increases as resistance becomes large. For high performance switches, such as plasma compression switch using explosives, the rate of resistance

NEM 94 EUROEM HPEM 94

BORDEAUX FRANCE - MAY 30 - JUNE 4 1994

EURO ELECTROMAGNETICS



International Symposium on Electromagnetic
Environments and Consequences

BOOK OF ABSTRACTS

PERMANENT NEM COMMITTEE

INTERNATIONAL UNION OF RADIO SCIENCE

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS