התאגדות מהנדסי
החשמל ואלקטרוניקה
בישראל 2002 (ע"ר)

מכון טכנולוגי חולון
Holon Institute of Technology

Israel IEEE EMC Chapter

IEEE - HIT 5th Conference on Electromagnetic Compatibility - EMC 2018

Keynote Speaker Abstracts and Biographies

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Examples of High-Power Electromagnetic (HPEM) Systems and some Applications of Short Pulse Technologies

Abstract

Many activities of civilized societies such as civil defense, air traffic safety and control, police, ambulance, communication and internet commerce are becoming increasingly dependent on advancements in computer and electronic systems. While this dependence results in enhanced quality of service, it comes at the price of increased vulnerability to a wide variety of threats to the society's infrastructure. One of the ways of classifying potential intentional electromagnetic environments (IEME) is based on frequency of coverage of the threat environment. In this paper, we will outline this classification, which is also consistent with current and emerging technologies in HPEM generation. Many examples of HPEM generators (from wall socket to radiated waves) are described, showing their capabilities, along with some illustrative applications in military and civilian sectors.

It is well established that sufficiently intense electromagnetic (EM) signals in the frequency range of 200 MHz to 5 GHz can cause upset or damage in electronic systems. One way of classifying the HPEM environments is based on the frequency content of their spectral densities as "narrowband", "moderate band", "ultra-moderate band" and "hyperband". To characterize these environments, we consider the bandratio of the EM spectrum as(/)hbrff=l. Using the inherent features of br in a manner consistent with the emerging EM field production technologies, the definitions for bandwidth classification has been proposed and formalized. The band ratio is closely related to the percent band width (pbw).

In this presentation, we shall provide examples of HPEM systems in each of the four bands cited above. For narrow band systems, high-power microwaves (HPM) (≥ 100 MW) operating in a single-shot or with tens or hundreds of Hz repetition rates are being developed in various countries and they are reaching power levels in the GW range, and are also frequency agile. They can be used to create intense electromagnetic signals in the range of ~ 500 MHz to 3 GHz, that can couple to and cause electronic damage in many systems.

Moderate band systems (source and antenna) have been built in the range of 100 MHz to 1 GHz. They integrate an oscillator into the antenna system. Examples are: (a) a low–impedance quarter wave transmission line oscillator feeding a high-impedance antenna. Ultra-moderate systems are basically hyperband systems with decreased bandwidth. TEM horn antennas have been used in fabricating such systems.

Hyperband systems have been built using paraboloidal reflectors fed by conical transmission lines. Their main attractive properties are: extremely wide bandwidth, without the adverse effects of dispersion. These systems are finding many applications in both military and civilian domains. These systems are capable of radiating very narrow (~ 100 ps) pulses into the far field of an antenna and lead to short pulse technologies. Some of the applications include: a) buried target detection such as demining, b) impulse radar, c) high-power, hyperband jammers and d) law enforcement applications such as "seeing through walls". Selected examples of such applications of short pulse technologies will also be presented.

Biography

Dr. Giri has over 40 years of work experience in the general field of electromagnetic theory and its applications in NEMP (Nuclear Electromagnetic Pulse), HPM (High-Power Microwaves), Lightning, and UWB (Ultra Wideband). A complete description of his academic training and work experience may be seen at his website:
HYPERLINK "http://www.dvgiri.com/" www.dvgiri.com
He obtained the B.Sc., Mysore University, India, (1964), B.E., M.E., Indian Institute of Science, (1967) (1969), M.S., Ph.D., Harvard University, (1973) (1975), Certificate, Harvard Introduction to Business Program, (1981). Since 1984, he is a self-employed consultant doing business as Pro-Tech, in Alamo, CA, performing R&D work for U.S. Government and Industry. He is also an Adjunct Professor in the Dept. of ECE, University of New Mexico, Albuquerque, New Mexico, USA.
Dr. Giri has taught graduate and undergraduate courses in the Dept. of EECS, University of California, Berkeley campus.
Dr. Giri was a Research Associate for the National Research Council at the Air Force Research Laboratory (AFRL), Kirtland AFB, New Mexico, where he conducted research in EMP and other aspects of electromagnetic theory.

LIFE FELLOW of IEEE,
Research Professor, Dept. of ECE, University of New Mexico, Albuquerque, NM
Member of Commission B, URSI
International Chairman of Commission E, URSI. (2104-2017)
Was an Associate Editor for the IEEE Transactions on EMC
SUMMA Foundation FELLOW
Book- High-Power Microwave Systems and Effects published by Taylor and Francis in 1994.
Recipient of the IEEE Antennas and Propagation Society's 2006 John Kraus Antenna Award.
Recipient of Hind Ratan and NRI of the year Awards during Republic Day 2017
His second book titled High-Power Electromagnetic Radiators: Nonlethal Weapons and Other Applications has been published by Harvard University Press in 2004.
He works with Prof. Raj Mittra, publishing an on-line Forum and Journal on Electromagnetics called FERMAT (www.e-fermat.org).

Prof. Michel Ianoz

COMPARISON BETWEEN HIGH ALTITUDE EMP AND HIGH POWER ELECTROMAGNETIC EFFECTS ON EQUIPMENT AND SYSTEMS

Abstract

The speech presents a review of the High Altitude EMP effects compared to the effects of High Power Microwaves (HPM).

The following parameters will be analysed and compared:

1. field sources; 2. spatial coverage; 3. time-domain behavior; 4. frequency spectrum; 5. field intensities; 6. Effects on installations and services.

Examples of HEMP effects measured using simulators on a reduced scale three phase line and on a real medium voltage line will be shown. In addition the HEMP effects at real scale on a 500 km telecommunication line in Soviet Union will be presented. In parallel, an example of an illumination with a power Microwave source on a car will also be presented.

Biography

Prof. Michel Ianoz, Michel Ianoz (Senior Member IEEE 85, Fellow IEEE 96) was born in 1936.

He received the B.S. degree in electrical engineering in 1958 and the Ph.D. degree in 1968.

From 1966 to 1973 he worked in different International Centers for Nuclear Research, in Russia and Switzerland.

In 1975 he joined the Power System Laboratory of the Swiss Institute of Technology in Lausanne (Switzerland) where he has been teaching EMC as a Professor of the Electrical Department and engaged in research activities concerning the calculation of electromagnetic fields, transient phenomena, lightning and EMP effects on power and telecommunication networks, and biological effects of EM fields, until he retired in 2001. He is now continuing his scientific activity as a Honorary Professor.

He is coauthor of a book "High Voltage Engineering", and of a book "EMC Analysis Methods and Computational Models" and author or coauthor of about 150 scientific papers, from which about 60 in internationally reviewed journals and conferences.

Prof. Ianoz was the Chairman of the Subcommittee 77B (HF phenomena) of the International Electrotechnical Commission (IEC) from 1997 to 2006 and President of the Swiss Committee of the URSI from 1993 to 2005. He has also been an Associate Editor of the IEEE Transactions on EMC, from 1994 to 2001. He has served as Distinguished Lecturer of the EMCS of the IEEE in 2003 and 2004. He an EMP Fellow since 1994 and IEEE Fellow since 1996. In 2000, Prof. Ianoz has received the title of Doctor Honoris Causa of the Technical University of St. Petersburg (Russia).

After he retired, Michel Ianoz has also published 2 novels and one travel relation in Russia and in the republics of former USRR.