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In Focus

THE MAGAZINE FOR THE CUSTOMERS OF TMD

IEEE

Fourth IEEE International Vacuum Electronics Conference
IVEC2003
Hotel Lotte, Seoul, Korea
May 28-30, 2003

EDS

TMD at IVEC 2003, Seoul

TMD will be attending the Fourth IEEE International Vacuum Electronics Conference (IVEC) both to give papers at the conference and as an exhibitor.

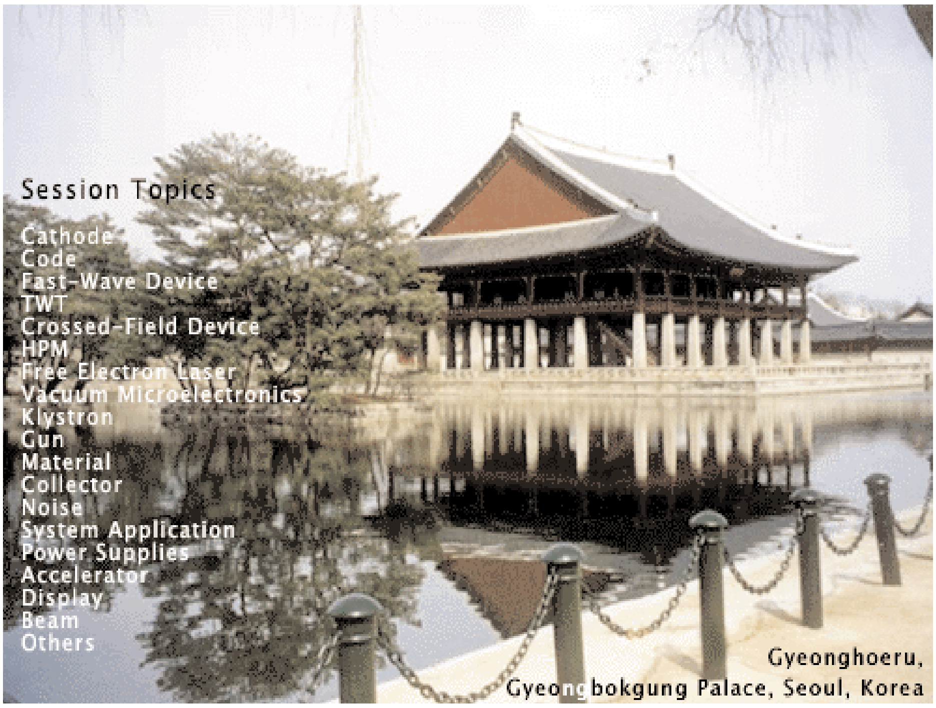
IVEC 2003 will take place on 28-30 May at the Lotte Hotel, Seoul, Korea. It will feature speakers from some 20 countries, attending lectures and technical sessions to share and promulgate the latest advances in the field of vacuum electronics. The conference is jointly organised by the Korean Physical Society, the Korea Accelerator & Plasma Research Association, and the School of Physics, Seoul National University.

In addition to IEEE/EDS, the sponsors include the IEE, ESA, EIA/MVED, AGED, MTEA, IEICE, JSPF, CVES, KPS, KAPRA, KVS, KAERI, PAL, KBSI, KIMST, Samsung, LG and KMW.

The event is chaired by Professor Gun-Sik Park, School of Physics, Seoul National University.

At the conference TMD will be focusing on its expertise in low noise power supplies, power supply/tube integration for radar transmitter subsystems, and also on the application of the latest software techniques for microwave tube design (see inside for details of papers to be given at IVEC 2003).

TMD's Sales Director, Graham Brown, said: "We look forward to welcoming our Korean customers to our stand along with many of our other international customers. We will be pleased to discuss new product developments and ways in which we can help meet your special requirements".



Gyeonghoeru, Gyeongbokgung Palace, Seoul, Korea

First AWACS Klystron Tested

The first prototype broadband klystron for the AWACS surveillance radar has now completed testing at TMD. The development of this tube in only 14 months represents a great achievement for TMD's Tubes Division - reflecting the skill and dedication of the engineering team.

It also highlights the benefits of the company's recent investment in the latest MAFIA, SDRC Ideas and Vector Fields suite software design tools.

Testing is progressing well, with results as predicted.

Graham Phillips, Technical Manager, Large Tubes, pictured testing the first prototype klystron for AWACS.

In Focus

RESEARCH

Numerical Analysis of Ring Loop and Ring Bar Slow Wave Structures for Travelling Wave Tubes

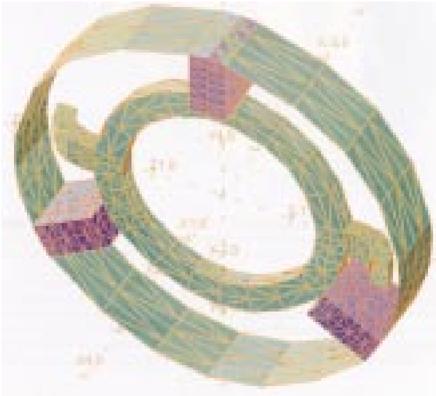
D.R. Dyson, TMD (based on a paper to be given at IVEC 2003)

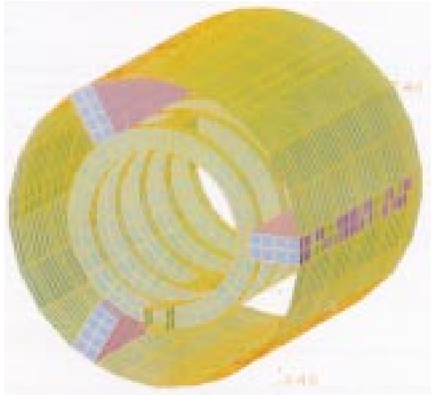
Ring loop and ring bar slow wave structures are used for many travelling wave tubes employed in specialised radar systems, where the controlled bandwidth and high gain-for-length characteristics can offer substantial advantages over alternative approaches to TWT design.

These structures, originally used to overcome the tendency of helix structures to backward wave oscillation when stretched to higher peak power levels of operation have, with the advancement of modelling and manufacturing methods to extend design performance, lately been proven capable of competing with numerous other parameter merits.

The paper describes the use of numerical methods to precisely predict the characteristics of ring loop and ring bar slow wave structures, and provides examples of the close agreement obtainable between predicted and actual measured performance of TWTs.

The microwave properties of the structures have been modelled using commercially available 3D, high frequency electromagnetic, software packages, based on the use of the finite element method. This has been enabled by means of in-house developed routines for describing the exact ring loop or ring bar geometry (see figures 1 and 2).





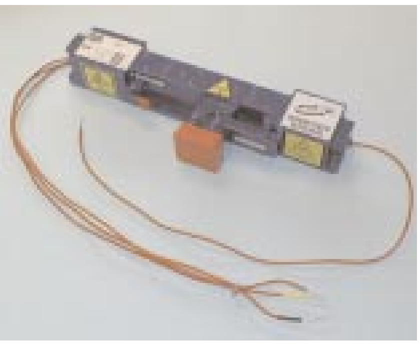
(Figs 1 & 2). Half-cell of the 3D ring loop geometry (left) and five half-cell hexahedrally meshed ring bar model.

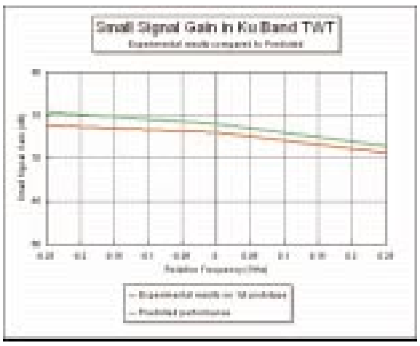
Essentially, short resonant lengths of structure are defined, with the software used to find the eigenvalue solutions. By selection of lengths and the imposition of appropriate plane boundary conditions, a sufficient picture of the resonant conditions across a whole range of phase changes per structural period is assembled, which can then be converted to a continuous function by fitting to a suitable polynomial function. By this means phase and group velocity conditions can be determined for any frequency of propagation. The numerical data from the simulation is further processed to establish stored energy levels within the model and this, combined with the dispersion analysis, is used to calculate the interaction impedance as presented to the injected beam.

The analysis technique is fast and readily incorporated into automated software tools together with proven analytical simulation models, enabling new designs and iterations to be evaluated and compared for relative performance merit. TMD has developed and applied this simulation technique to ring loop and ring bar TWT designs from L band to Ku band.

Figure 3 shows a Ku band TWT designed using the above techniques, and figure 4 gives the level of agreement obtained in prediction of the small signal gain characteristics.

Although the detailed design of TWTs at TMD is served by a number of advanced software models (including electron dynamics for gun modelling and particle-in-cell for interaction modelling), the accurate numerical analysis tool described above, which is able to be applied quickly and easily to judge the relative merits of structural design options, remains a key contributor to the successful design process.





(Figs 3 & 4). Ku band ring loop travelling wave tube (left) and a graph showing the comparison between modelled and actual small signal gain. The red rule indicates experimental results on first prototype, whilst the green rule is predicted performance.

DEVELOPMENT   In Focus

Design of Multi-mode Transmitter Subsystems for Low Phase Noise and High PRF Airborne Applications

(D. Newton, TMD (based on a paper to be given at IVEC 2003)

TMD is an independent company expert in radar transmitter subsystems design, development and manufacture.

The company's unique position derives from more than 50 years experience of microwave tubes, with 20 years at the cutting edge of switched mode power supply design and, in the last 10 years, a wealth of experience in power supply/tube integration.

During this time a wide variety of ruggedised radar transmitter subsystems have been produced, adapted to customers' particular requirements.

Shown in the photo is a typical unit comprising a high voltage switched mode power supply, ring loop or helix TWT, cooling system, VSWR protection, radar interface and BIT (built-in test). An introduction to the design principles is given below.

A typical TWT block diagram will be presented with a simple explanation of TWT theory of operation, and an overview of the high voltage power supply (HVPSU) and modulator requirements for operation of the TWT. This will also encompass electrode voltage ripple requirements for achieving a very good close-to-carrier added noise performance.

Also, the paper will describe many of the special features of our switch mode power supplies; for example, high voltage TWT PSUs that are able to operate with low, medium, and high PRF schedules and also provide low phase noise - usually require synchronisation (PRF locking). A design will be presented that is truly multi-mode (no synchronisation), providing a wide range of PRF (0-200 kHz) and pulse length (0.2-100 microsec), with a spurious phase noise of -90 dBc and random of -120 dBc/Hz or better.

This technology is particularly relevant to engagement at high Mach number for airborne intercept and fire control radars.

The paper will detail some of the functional blocks of the power supply design which enable the performance to be achieved, and will also present illustrations and typical performance results of an X band 8 kW, pulsed 5% duty cycle radar transmitter.

TMD Around the World

In Sweden, Italy ...

An important part of Sue Garg's role since she joined TMD as Sales Manager last year has been the development of totally new business, by making contact and developing relationships with companies we have not previously dealt with and by introducing new products to those we are already doing business with.

This assignment has involved a substantial amount of foreign travel. In the last few months Sue has made several trips to Sweden, visiting the towns of Möndal near Gothenberg and Järfalla near Stockholm.

Earlier this year she visited Rome for discussions with AMS, MBDA and Oerlikon Contraves.

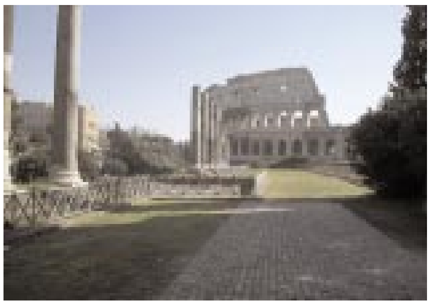
and India

TMD's Sales Director Graham Brown and Sales Manager Andy Crawford recently spent some time in India, visiting customers and further consolidating working relationships established over several years.

'India has now become an important market for TMD'

India has now become an important market for both microwave tubes in existing legacy systems and for our new transmitters for indigenous programmes.

Pictured is a new ground mobile radar transmitter, cleverly disguised as a mule with horns (note the perfectly formed antennae)!



Sue Garg recently visited Rome.

New Appointments

Jorg Dunn

In March of this year Jorg Dunn joined TMD as Sales Manager.

Jorg started his career in the high technology electronics sector as a product design engineer involved with power and aviation control systems. During this time he attained an honours degree in Electrical and Electronic Engineering at the University of London.

In 1993 Jorg joined Nortel, working as a Project Manager in the telecommunications sector, supporting the company's full range of turnkey solutions for the Wireless Enterprise and NLOs (New License Operators). In order to increase his commercial acumen, Jorg then held the position of Business Development Manager responsible for the development of a £30 million business unit within Nortel across Europe, the Middle East and Africa (EMEA).

A few years later Jorg joined GEC Marconi as EMEA Sales Director, with the task of developing and managing sales opportunities across EMEA.

Hari Singhota

Hari Singhota joined TMD early this year as Contracts Administrator, including responsibility for exports and freight. Hari has many years experience and an impressive record in this field, having progressed from Export Clerk at TNT to Operations Manager.

In addition, Hari worked for British Rail where he was employed in a customer services department at head office, and also set up a worldwide freight operation.

Mike Clark

Last Autumn Mike Clark was promoted from Engineering Manager, Tubes Division to overall Tubes Divisional Manager.

Roger Gates has taken over the role of Engineering Manager, Tubes Division, whilst other changes in the divisional organisation include George Wakeman's appointment to the new position of Business Development Manager, Andy Lowe's promotion to Operations Manager, and David Dyson's promotion to Head of the Design Group.

Jorg Dunn

Hari Singhota

Nigel Hann

Nigel Hann has recently moved to the new position of Assistant to the Sales Director. Nigel will be dealing with all the day to day business when Sales Director Graham Brown is out of the office, and will also play a major role in strategic planning and marketing.

Graham Brown said: "Nigel's wide knowledge and experience, gained from his 20 years in the microwave industry - 13 of which have been with TMD - is proving invaluable in all areas of the business. This new move is certain to benefit everyone as we continue to enhance and strengthen support to our growing worldwide customer base".

TMD on Show

Left to right: Basil Eastwood, British Ambassador; George Wakeman, TMD; Nigel Griffiths, UK Minister for Small Business, and Guy Howard, TMD.

Last November Guy Howard, TMD's Sales Manager, Commercial Products, and George Wakeman, Business Development Manager, Tubes Division, attended the Britain @CERN exhibition in Geneva.

TMD has a long history of working with CERN in many different areas of technology, covering TWT and solid state amplifiers, electron guns, fabrication of specialised brazed sub-assemblies, and high power klystrons.

New Web Site

A TMD web site has been in existence since 1995, but last year we decided it was time for a makeover. So we engaged Appius E Business to totally re-design the site, which they completed successfully in record time.

We have focused particularly on making the new site as user friendly as possible and would be pleased to receive any suggestions for improvement to Heather Skinner, Publicity Manager.

TMD

TMD Technologies Limited
Swallowfield Way, Hayes, Middlesex UB3 1DQ UK
Telephone: 020 8573 5555 or
+44 (0)20 8573 5555 (international)
Fax: 020 8569 1839
http://www.tmd.co.uk/

Customer Care
wecare@tmd.co.uk

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