Session 10. Modeling-II

April 30 (Tuesday) / 10:20 ~ 12:00 / Room 1

Session Chair: Khanh Nguyen (Beam Wave Research, Inc., USA)

10:20 ~ 10:40

10.1 / [Keynote] Elastostatics in Beam Optics Analyzer

Thuc Bui (Calabazas Creek Research Inc., USA), David Marsden (Calabazas Creek Research Inc., USA), R. Lawrence Ives (Calabazas Creek Research Inc., USA)

Beam Optics Analyzer has the new capability to perform stress analysis making it a truly multiphysics computational tool. Finite element formulation of elastostatics will be described, and thermal stress analysis from radiation and electrons heating a triode control grid will be presented.

10:40 ~ 11:00

10.2 / Simulation of a Double-gap Coupled Cavity Based on Finite Element Method

Hangxin Liu (University of Electronic Science and Technology of China, China), Li Xu (University of Electronic Science and Technology of China, China), Xiaofang Zhu (University of Electronic Science and Technology of China, China), Zhonghai Yang (University of Electronic Science and Technology of China, China), Bin Li (University of Electronic Science and Technology of China, China)

In Extended Interaction Klystrons (EIK), multiple interaction gaps within one cavity is used to increase the impedance of the cavity eigenmode, decrease the voltage between each gap, and enhance the power capability of the cavity. It is significant to project numerical simulation method used in the analysis of cavities with multiple coupled gaps. In this paper, using the finite element method, a simulator named High Frequency Circuit Simulator for Cavity (HFCS-C) was developed and used for design and analysis of multi-gap coupled cavity. To validate HFCS-C, numerical results for a double-gap coupled cavity structure are compared with HFSS in detail.

11:00 ~ 11:20

10.3 / Optimization of the Cut-cell Mesh-Generating Code for Simulation of Vacuum Electronic Devices

Wenjin Cai (University of Electronic Science and Technology of China, China), Xiaolin Jin (University of Electronic Science and Technology of China, China), Xiaoliang Gu (University of Electronic Science and Technology of China, China), Tao Huang (University of Electronic Science and Technology of China, China), Bin Li (University of Electronic Science and

Technology of China, China)

A cut-cell mesh-generating code was developed and optimized to simulate vacuum electronic devices. This code can provide the needed Cut-cell mesh when simulating vacuum devices by conformal Finite Differential Time Domain (FDTD) method. This article was focused on the efficiency improvement of the Cut-cell mesh-generation code. The test results show that the meshing efficiency is greatly improved while maintaining the certain computational accuracy.

11:20 ~ 11:40

10.4 / Backward-Wave Oscillator with Distributed Power Extraction Based on Exceptional Point of Degeneracy and Gain and Radiation-Loss Balance

Tarek Mealy (University of California, USA), Ahmed F. Abdelshafy (University of California, USA), Filippo Capolino (University of California, USA)

We propose a new design paradigm for power efficient backward-wave oscillators (BWOs). Conventional BWOs exhibit small starting current and limited power efficiency. We introduce the concept of distributed radiation loss in a hot slow wave structure (SWS) working at an exceptional point of degeneracy (EPD) to achieve high power extraction from the electron beam aiming at high power efficiency. We show how the simultaneous presence of distributed radiation loss and distributed gain arising from the electron beam can be exploited to realize an EPD. In principle this new condition guarantees full synchronization between the electromagnetic (EM) guide mode and the charge wave for any amount of beam current and power extracted. We show how radiating EM modes (viadistributed apertures) with backward propagation in the SWS and interacting with the charge wave are engineered to exhibit a second order EPD. We also show that including distributed radiation-losses in the design results in having high threshold current which implies higher power generation.

11:40 ~ 12:00

10.5 / Self-Similar Analysis of Short Pulse Amplification and Generation in Cherenkov-type Devices

Alena Rostuntsova (Saratov State University, Russia), Nikita M. Ryskin (Institute of Radio Engineering and Electronics RAS, Russia), Naum S. Ginzburg (Institute of Applied Physics RAS, Russia)

The equations describing the interaction of an electron beam with an electromagnetic wave in Cherenkovtype vacuum tube devices allow a self-similar solution describing amplification and compression of short electromagnetic pulses. In this paper, we discuss the main features of the self-similar solutions and present the results of detailed numerical simulations, which confirm the theoretical analysis.