Session 1. Modeling-I

April 29 (Monday) / 10:20 ~ 11:40 / Room 1

Session Chair: Dave Smithe (Tech-X Corporation, USA)

10:20 ~ 10:40

1.1 / [Keynote] Design and Simulation of W-band Second Harmonic Periodically Loaded Gyro-TWT Amplifier

Akash (Indian Institute of Technology, India), Thottappan (Indian Institute of Technology, India)

A W-band gyro-TWT amplifier using a periodic lossy dielectric disc loaded RF interaction structure operating in second harmonic TE_{02} mode is presented. The dielectric loaded linear section is used to suppress the potential BWOs. The present gyro-TWT is modeled in 3D particle-in-cell (PIC) tool to study its beam-wave interaction behavior. The simulation shows a peak power of 600kW in a second harmonic TE_{02} mode for the DC drive of 100kV, 25A. The electronic efficiency of the present amplifier is calculated as ~24% and the saturated gain is ~30dB. The -3dB bandwidth of the amplifier is 4.2GHz.

10:40 ~ 11:00

1.2 / DIMOHA: Traveling-wave tube simulations including band edge and multiple-carriers operations

Damien Minenna (Centre National d'E´tudes Spatiales / Aix-Marseille Université / Thales AVS, France), Yves Elskens (Aix-Marseille Université, France), Frédéric André (Thales AVS, France), Jérôme Puech (Centre National d'E´tudes Spatiales, France), Alexandre Poyé (Aix-Marseille Université, France), Fabrice Doveil (Aix-Marseille Université, France), Telma Pereira (Thales AVS, France)

A new kind of time domain simulation for travelingwave tube (TWT) is presented. The DIMOHA algorithm should be considered as an alternative to current particle-in-cell (PIC) and frequency approaches. To assess its validity, a comparison with a commercial Ku-band tapered helix TWT is performed. It shows an excellent agreement for the output power and the nonlinear phase shift at various frequencies. The algorithm is also tested near the band edge and for multitone simulations, both with success.

11:00 ~ 11:20

1.3 / Study on beam wave interaction and mode competition in a fusion gyrotron using 3-D EM PIC simulation

Ming-Chieh Lin (Hanyang University, Korea), David N. Smithe (Tech-X Corporation, USA)

3-D time-domain modeling of beam wave interaction in a fusion gyrotron is very challenging due to the open-end features of cavity structure and higher-order mode excitation employed to achieve high efficiency. In a previous project, namely GyroPIC, funded by DOE, several required capabilities or algorithms had been developed in a 3-D particlein-cell (PIC) simulation code in order to simulate the beam wave interaction in a high-order mode gyrotron. In past decades, it has been considered as an impossible mission to simulate a fusion gyrotron in 3-D using a PIC based method. The preliminary results showed that the 3-D electromagnetic (EM) PIC method could provide an alternative modeling tool for studying the gyrotron cavity interaction and mode competition for gaining more physics insight and further improving the efficiency. Upon finishing the code development, a research effort has been continued in recent years to study the beam wave interaction and mode competition using the well-developed 3-D EM PIC simulation.

11:20 ~ 11:40

1.4 / Large-scale parallel particle-in-cell code CHIPIC

Dagang Liu (University of Electronic Science and Technology, China), Huihui Wang (University of Electronic Science and Technology, China), Laqun Liu (University of Electronic Science and Technology, China), Mengjun Xie (University of Electronic Science and Technology, China)

A Large-scale Particle-in-cell (PIC) simulation code, CHIPIC, is introduced. This reports presents the parallel algorithm used in our code, and large-scale parallel particle-in-cell (PIC) simulations on MILO, RKA, TWT, and C-band MBK by making use of the Milky Way High Performance Computing platform.