Contribution ID: **1096** Type: **Poster**

2P28 - Dispersion Engineering for O and M-Types High Power Microwave Sources

Tuesday 25 June 2019 13:00 (1h 30m)

The design and the development of High-Power Microwave (HPM) sources today relies heavily on Particle-In-Cell (PIC) codes, which allow the source concepts to be virtually prototyped and optimized prior to being built experimentally. The current state of source development consists of developing the geometry of the structure, extracting the dispersion relation from the eigenmodes, evaluating the dispersion properties, and finally adjusting the geometry to obtain the desired wave dispersion [1]. O-type devices and amplifiers have an advantage in having axial symmetry, which can be simulated with a single slow wave structure and periodic boundary conditions [2-3]. The dispersion relation for M-type devices, however, cannot be constructed in the same way due to the entire period being 2π. The UNM HPM group found a methodology that can ease the extraction of the dispersion curve from M-type devices, such as the magnetron or Mitron (inter-digital magnetron), which can be a novel method for dispersion engineering of cross-field devices.

This work explores a methodology for deriving the dispersion relations for O- and M-type devices and attempts to simplify the process of dispersion engineering from the required dispersion characteristics to the corresponding geometry.

1. E. Schamiloglu, "Dispersion Engineering for High Power Microwave Amplifiers,"in Proceedings of the 2012 EAPPC-Beams Conference, Karlsruhe, Germany, Sept., 2012.
2. S.C. Yurt, Design of an O-Type Metamaterial Slow Wave Structure for High Power Microwave Generation (Ph.D. Dissertation, University of New Mexico, Albuquerque, NM, 2017).
3. R.K. Singh, "Cold Analysis for Dispersion, Attenuation and RF Efficiency Characteristics of a Gyrotron Cavity,"World Academy of Science, Engineering and Technology, International Journal of Electrical, Computer, Energetic, Electronic and Communication Engineering, vol. 6, 1233-1238, 2013.

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Session Classification: Poster - Microwave Generation and Plasma Interactions and Pulsed Power Switches and Components

Track Classification: 2.5 Codes and Modeling