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Waveguide-based complementary metamaterial for high-power microwave generation and particle acceleration[1] GENNADY SHVETS, The University of Texas at Austin, MICHAEL SHAPIRO, RICHARD TEMKIN, MIT, WILL FRIERSON, SIMEON TRENDAFILOV, The University of Texas at Austin
— A novel over-moded metallic structure based on sub-wavelength meta-waveguides patterned by complementary metamaterials (C-MTM) is proposed as a potential electromagnetic structure for particle acceleration and radiation generation. One of the advantages of this structure is planar fabrication which is advantageous for short-wavelength applications. A transmission line theory of the mode propagation and interaction with the electron beam is developed. It is shown that the structure supports a negative-index accelerating mode that can resonantly interact with a relativistic electron beam. In the context of radiation generation, the proposed structure can be utilized as a Backward Wave Oscillator. Using COMSOL simulations, it is shown that the beam-mode interaction results in the mode's exponential growth. Mode competition and the excitation of deleterious transverse wakes will also be discussed. Both positive and negative index TM modes strongly interacting with the beam are identified.

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