501. Title:Enhanced stability of second- and fourth-harmonic gyrotrons driven by a frequency-doubled prebunched beam
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Abstract:There is currently considerable interest in operating gyrotrons at the second and higher cyclotron harmonics in order to access the near-terahertz regime while reducing magnetic field requirements. High-frequency gyrotrons have successfully operated at the second harmonic. However, competition from the fundamental harmonic increasingly limits operation in the higher order modes needed for the near-terahertz regime. Savilov recently proposed a scheme for frequency-doubled phase bunching of gyrating electron beams in a waveguide resonator formed from Bragg reflectors and with the drive frequency equal to the cyclotron frequency. The advantages of phase prebunching at twice the cyclotron frequency include suppression of the fundamental harmonic, enhanced second-harmonic operation, and increased likelihood of fourth-harmonic operation. We have investigated the use of this phase bunching technique to enhance higher harmonic operation in gyrotron oscillators with annular beams. We compute the frequency-doubled bunching produced by a Bragg-type prebunching cavity and use a large-signal, multimode, and multiharmonic gyrotron oscillator code to simulate the effect of this bunching on a highly overmoded output cavity. Regimes of stable operation are predicted for the second- and fourth-harmonic point designs.