Abstracts

Fundamental and Subharmonic Excitation for an Oscillator with Several Tunneling Diodes in Series

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Connecting several tunneling diodes in series shows promise as a method for increasing the output power of these devices as millimeter-wave oscillators. However, due to the negative differential resistance (NDR) region in the dc I-V curve of a single tunneling diode, a circuit using several devices connected in series, and biased simultaneously in the NDR region, is dc unstable. Because of this instability, an oscillator with several tunneling diodes in series has a demanding excitation condition. Excitation using an externally applied RF signal is one approach to solving this problem. This is experimentally demonstrated using an RF source, both with frequency close to as well as with frequency considerably lower than the oscillation frequency. Excitation by an RF source with a frequency as low as one sixth of the oscillation frequency was demonstrated in a proof-of-principle experiment at 2 GHz, for an oscillator with two tunnel diodes connected in series. Strong harmonics of the oscillation signal were generated as a result of the highly nonlinear dc I-V curve of the tunnel diode and a large signal oscillator design. Third harmonic output power comparable to that of the fundamental was observed in one oscillator circuit. If submillimeter wave resonant-tunneling diodes (RTD's) are used instead of tunnel diodes, this harmonic output may be useful for generating signals at frequencies well into the terahertz range.

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