Terahertz response of a field-effect transistor loaded with a reactive component

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Abstract

A study of the small-signal response of a Field-Effect Transistor connected to a purely reactive load is proposed. In particular, this model, using the equivalent admittances approach, is applied to a transistor connected to an inductance L, a capacitance C and LC resonant and anti-resonant circuits. The influence of such frequency-dependent load on the dynamics of the transistor, dominated in the terahertz range by collective plasma behavior, is investigated. This leads to the possibilities of shifting, amplifying or softening resonances appearing in the voltage gain spectrum. The effect of a resistive part of the load is also estimated.

Keywords: Field-Effect Transistor, TeraHertz frequency (THz), voltage gain, resonant circuit, plasma oscillations.

1. Introduction

The nanometric Field-Effect Transistors (FETs) present several potential applications at the terahertz (THz) frequencies specifically, in three domains: detectors, sources and amplifiers [1, 2, 3, 4, 5]. Particularly, High-Electron Mobility Transistors (HEMTs) devices exhibit THz resonances in the small-signal admittance spectrum for short gate-length transistors [6]. The excitation of plasma oscillations in FETs demonstrates their important effect related to

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