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Title: Charge density and plasmon modes in a triangular quantum well model for doped and undoped gated AlGaN/GaN HEMTs
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Abstract: We have calculated the plasmon frequency of the two-dimensional electron gas (2DEG) in AlGaN/GaN high electron mobility transistors (HEMT). The impact of HEMT's parameters on the plasmon frequency and the sheet charge density of the 2DEG is discussed in detail. The charge density in the HEMT's channel is calculated by means of a triangular quantum well model. It has been found that the AlGaN/GaN heterostructure induces plasmon oscillations in the THz range with larger frequencies compared with other semiconductor compounds. The sensitivity of the tunability of these frequencies is considerable, especially using a variable applied gate voltage. We have derived optimal structure parameters for obtaining a maximum plasmon frequency for a given doping concentration. We will show that the accuracy of this optimized frequency value is dependent on the average position Delta d of charge density in the triangular shaped (quantum well) channel. The interaction between radiation and plasmons has many applications such as detectors, mixers and generators of THz waves.