Research note

Current-voltage characteristic of a resonant tunneling diode under electromagnetic radiation

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Abstract
In this paper, current-voltage characteristic of a resonant tunneling diode under electromagnetic radiation has been calculated and compared with the results when there is no electromagnetic radiation. For calculating current -voltage characteristic, it is required to calculate the transmission coefficient of electrons from the well and barrier structures of this device. For calculating the transmission coefficient of electrons at the presence of electromagnetic radiation, Finite Difference Time Domain (FDTD) method has been used and when there is no electromagnetic radiation Transfer Matrix Method (TMM) and finite diffirence time domain method have been used. The results show that the presence of electromagnetic radiation causes resonant states other than principal resonant state (without presence of electromagnetic radiation) to appear on the transmition coefficient curve where they are in $\hbar\omega$ distances from the principal peak and from each other. Also, the presence of electromagnetic radiation causes peaks other than principal peak to appear on the current-voltage characteristics of the device. Under electromagnetic radiation, the number of peaks on the current-voltage curve is smaller than the number of peaks on the current-voltage transmission coefficient. This is due to the fact that current-voltage curve is the result of integration on the energy of electrons, Thus, the sharper and low height peaks on the transmission coefficient do not appear on the current-voltage characteristic curve.

Keywords: tunneling diode, resonant tunneling, transmission coefficient, negative differential resistance

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