Re-examination of Subband Structure Engineering in Ultra-Short Channel MOSFETs under Ballistic Carrier Transport

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This paper proposes a new design methodology of MOS channel engineering based on the optimization of subband structures under full-ballistic transport. It is shown from the analyses of ballistic transport combined with subband structure calculations that (111) Ge MOSFET, (100) ultrathin SOI MOSFET and (111) ultrathin Ge-On-Insulator MOSFET can exhibit higher drain saturation current. The advantage of ultrathin body structure is attributed to the increase in both energies of subbands in the second ladder and higher subband in the first ladder.