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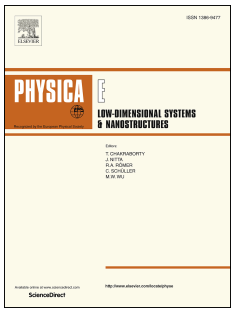

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Analytical study of nano-scale logical operations

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Abstract

A complete analytical prescription is given to perform three basic (OR, AND, NOT) and two universal (NAND, NOR) logic gates at nano-scale level using simple tailor made geometries. Two different geometries, ring-like and chain-like, are taken into account where in each case the bridging conductor is coupled to a local atomic site through a dangling bond whose site energy can be controlled by means of external gate electrode. The main idea is that when injecting electron energy matches with site energy of local atomic site transmission probability drops exactly to zero, whereas the junction exhibits finite transmission for other energies. Utilizing this prescription we perform logical operations, and, we strongly believe that the proposed results can be verified in laboratory. Finally, we numerically compute two-terminal transmission probability considering general models and the numerical results matches exactly well with our analytical findings.

Keywords: Nano-scale logic gates; Anti-resonant states; Transfer matrix method; Analytical study.

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