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Simulation of a GNR-FET

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Device engineers devote considerable effort for developing transistor designs in which short-channel effects are suppressed and series resistances are minimized. Scaling theory predicts that a field effect transistor (FET) with a thin barrier and a thin gate-controlled region will be robust against short-channel effects down to very short gate lengths. The possibility of having channels that are just one atomic layer thick is perhaps the most attractive feature of graphene for its use in transistors. Main drawbacks of a large-area monolayer graphene are the zero gap and, for graphene on substrate, the degradation of the mobility. A possible way to overcome this problem consists to adopt narrow strips of graphene, called nanoribbons (GNR), because the spatial confinement of carriers induces a band gap [1, 2], but the mobility reduces with respect to the large area graphene sheet.

We simulate a field effect transistor in the case the active area is made by a single graphene nanoribbon (GNR-FET). The geometry is similar to the one proposed in [3]. We adopt the drift-diffusion model in the degenerate case coupled with the Poisson equation. The mobility model is deduced by a fitting procedure on extensive simulation of the homogeneous Boltzmann equation for charge transport in GNRs solved by a discontinuous Galerkin deterministic numerical method [4].

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