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Effect of Disorders in Graphene Nanoribbon Field-Effect Transistors YOUNGKI YOON, U of Florida, GIANLUCA FIORI, Università di Pisa, SEOKMIN HONG, U of Florida, GIUSEPPE IANNACCONE, Università di Pisa, JING GUO, U of Florida — Recent progress on the graphene and graphene nanoribbon (GNR) has provoked strong interests in GNR field-effect transistors (FETs) for future digital and analog nanoelectronics applications. In this work, device characteristics of GNRFETs are calculated by solving the non-equilibrium Green's function (NEGF) transport equation in an atomistic p_Z orbital basis set self-consistently with three-dimensional (3D) Poisson equation. The effects of a lattice vacancy, ionized impurity, and edge roughness on transistor performance and characteristics are examined by the atomistic simulations. We show that even a single disorder can have a significant effect on the device characteristics of GNRFETs due to the atomically thin and nanometer-wide channel geometry. For example, a single lattice vacancy can affect the on-current of a GNRFET by 40%. Localized states in the GNR band gap energy range can be induced by the disorders, which affect quantum transport and self-consistent electrostatics. Significant variations between devices are expected due to disorders, but the GNRFETs still switch in the presence of moderate amount of disorders.

Jing Guo
University of Florida

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