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Current-driven domain wall ratchet in a nanomagnet with functionally graded Dzyaloshinskii-Moriya interaction KOSTIANTYN V. YERSHOV, Bogolyubov Institute for Theoretical Physics, Ukraine, DENIS D. SHEKA, Taras Shevchenko National University of Kyiv, Ukraine, VOLODYMYR P. KRAVCHUK, YURI GAIDIDEI, Bogolyubov Institute for Theoretical Physics, Ukraine, AVADH SAXENA, Los Alamos National Lab — We develop a concept of functionally graded Dzyaloshinskii-Moriya interaction, which provides novel ways of efficient control of the magnetization dynamics. Using this approach we realize the ratchet motion of the domain wall in a magnetic nanowire driven by spin polarized current with potential applications in magnetic devices such as race-track memory and magnetic logical devices. By engineering the spatial profile of Dzyaloshinskii-Moriya parameters we provide a unidirectional motion of the domain wall along the wire. We base our study on phenomenological Landau-Lifshitz-Gilbert equations using a collective variable approach [1]. In effective equations of motion the functionally graded Dzyaloshinskii-Moriya interaction appears as a driving force, which can either suppress the action of the pumping by the current or can reinforce it. All analytical predictions are well confirmed by numerical simulations.
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