

Nonadiabatic Ratchet Effect in Superconducting Films With a Tilted Cosine Pinning Potential

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Influence of an alternative current of arbitrary amplitude and frequency on the mixed-state dc-voltage-ac-drive ratchet-response of a superconducting film with a dc-tilted uniaxial cosine pinning potential at finite temperature is theoretically investigated. The results are obtained within the frames of exact solution of the corresponding Langevin equation in terms of a matrix continued fraction¹. Formulas for dc ratchet response and absorbed power as functions of ac amplitude, frequency, and dc tilting current are analyzed in a wide range of corresponding dimensionless parameters. Special attention is paid for physical interpretation of obtained results in adiabatic and high-frequency ratchet responses taking into account both running and localized states of the (ac+dc)-driven vortex motion in the washboard pinning potential. Our theoretical results are discussed in comparison with a recent experimental work on high-frequency ratchet response in nanostructured superconducting films².

¹V. A. Shklovskij and O. V. Dobrovolskiy, Phys. Rev. B **78**, 104526 (2008).

²B. B. Jin, B. Y. Zhu, R. Wördenweber, C. C. de Souza Silva, P. H. Wu, and V. V. Moshchalkov, Phys. Rev. B **81**, 174505 (2010).