DC conductivity in a s-wave superconducting single vortex system

E. Arahata[a] and Y. Kato[b]

[a]Research Institute of Industry, The University of Tokyo
[b]Department of Basic Science, The University of Tokyo

One of the phenomena attracting attention is the dynamics of the vortex in type-II superconductors. Particularly, the Hall effect in the vortex state remains controversial. The quasiclassical Green function approach proved to be very useful for description of many properties both in superconducting single vortex systems. However, the quasiclassical equations, e.g. the Eilenberger equation[1], are unable to describe the flux flow Hall effect in the mixed state of superconductors. Recently, some works have a success to include the terms corresponding to the Hall effect in the quasiclassical equations[2]. However, there is no numerical calculation to clear the validity of these approaches with experimental parameters. We study this problem by using the quasiclassical equations including Hall effect terms. We solve the quasiclassical equations generalized by Kita in order to calculate dynamics of s-wave superconductor in the presence of moving single vortex. We calculate the dc linear response in a self-consistent way numerically in the sense that the gap equation (for the pair potential), the Dyson equation (for the impurity self-energy) and Maxwell equation (for electromagnetic fields) are satisfied up to the first order of vortex velocity. We discuss temperature and purity dependence of conductivities in details.

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