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Search for Second-Order Josephson tunneling in SFS Josephson junctions[1] S.M. FROLOV, D.J. VAN HARLINGEN, (University of Illinois at Urbana-Champaign), V.A. OBOZNOV, V.V. BOLGINOV, A.K. FEOFANOV, V.V. RYAZANOV, (Institute of Solid State Physics, Chernogolovka, Russia) — SFS (Superconductor-Ferromagnet-Superconductor) Josephson junctions can exhibit transitions between ordinary Josephson (0-junction) tunneling and pi-junction behavior as a function of barrier thickness or temperature. Close to the 0-π crossover at which the first-order Josephson component vanishes, it has been predicted that second-order Josephson tunneling, characterized by a $sin(2\phi)$ component in the supercurrent, can dominate. If present, this component can be detected directly by measurements of the current-phase relation and can induce period doubling in the critical current diffraction patterns and generate half-integer Shapiro steps. However, such effects can also arise near the 0-π transition from a distribution of 0-junction and π-junction regions due to a non-uniform ferromagnetic barrier. We compare the results of measurements on junctions with uniform and non-uniform ferromagnetic barriers to determine whether observed second harmonics arise from a microscopic $sin(2\phi)$ component or from junction non-uniformity.

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