MAR09-2008-004467

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Flux-driven Josephson parametric amplifier

TSUYOSHI YAMAMOTO[1], NEC Corporation

Degenerate parametric amplifiers are phase sensitive amplifiers, which can in principle amplify one of the two quadratures of a signal without introducing extra noise. Parametric amplifiers based on the nonlinear inductance of a Josephson junction have been studied for a long time. Recently, there has been a renewed interest in parametric amplifiers due in part to the increasing need for quantum- limited amplification in the field of quantum information processing using superconducting circuits. In the present work, we design a novel Josephson parametric amplifier, comprising a superconducting transmission-line resonator terminated by a dc SQUID. Contrary to the previous works, the pump is not used to directly modulate a current through the Josephson junction, but is instead used to modulate a flux through the dc SQUID. Because the dc SQUID determines the boundary condition of the resonator, the flux modulation gives the temporal variation of the resonant frequency, which leads to the parametric amplification of the signal coming into the resonator. The practical advantage of the scheme is, first, that the band center of the signal is widely controllable by a dc flux also applied to the SQUID. Second, as the pump and the signal are applied to different ports and their frequencies are twice different, it is straightforward to separate the output signal from the pump. We have operated such a flux-driven Josephson parametric amplifier at around 10 GHz and characterized its basic properties.

[1]also at RIKEN and CREST-JST