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Improved Microwave Amplifiers Based on the dc SQUID YUNG-FU CHEN, DAVID HOVER, LEON MAURER, STEVE SENDELBACH, ROBERT MCDERMOTT, Department of Physics, University of Wisconsin-Madison, MICHAEL MUECK, Institut fur Angewandte Physik, Justus-Leibig-Universitat Giessen — The dc SQUID can be used as a sensitive microwave amplifier if the signal to be amplified is suitably coupled to the SQUID. We have designed and fabricated microwave amplifiers in which a coil integrated on top of the SQUID is operated as a half-wavelength-microstrip resonator. Such amplifiers have a power gain of up to 100 at 1 GHz, and 4 at 8 GHz. When cooled to millikelvin temperatures, sensitivities close to the quantum limited could be obtained at 500 MHz. By applying negative feedback and adding a few passive components, the input and output impedances of the amplifiers can be brought close to 50 ohms, with only a modest reduction in gain. The robust match to 50 ohms makes it possible to cascade multiple SQUID gain stages, and thereby enhance device performance. We describe novel configurations of the input resonator that allow operation at higher frequencies, and discuss application of these amplifiers to the readout of superconducting quantum circuits.

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