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Superconducting nanowires as nonlinear inductive elements for qubits[1] JASEUNG KU, University of Illinois at Urbana-Champaign, VLADIMIR MANUCHARYAN, Yale University, ALEXEY BEZRYADIN, University of Illinois at Urbana-Champaign — We report microwave transmission measurements of superconducting Fabry-Perot resonators, having a superconducting nanowire placed at a supercurrent antinode. As the plasma oscillation is excited, the supercurrent is forced to flow through the nanowire. The microwave transmission of the resonator-nanowire device shows a nonlinear resonance behavior, significantly dependent on the amplitude of the supercurrent oscillation. We show that such amplitude-dependent response is due to the nonlinearity of the current-phase relationship of the nanowire. The results are explained within a nonlinear oscillator model of the Duffing oscillator, in which the nanowire acts as a purely inductive element, in the limit of low temperatures and low amplitudes. The low-quality factor sample exhibits a "crater" at the resonance peak at higher driving power, which is due to dissipation. We observe a hysteretic bifurcation behavior of the transmission response to frequency sweep in a sample with a higher quality factor. The Duffing model is used to explain the Duffing bistability diagram.

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