Modeling the Behavior of HTS Terahertz RSQUIDs

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Abstract - In previous work we looked in detail at simulations of our HTS Resistive DCSQUIDs (RSQUIDs) using a lumped-component model and neglecting step-edge junction capacitance. These can now be made with junctions that have a high product of critical current and normal resistance (I_cR_J) and so the Josephson frequency can be above 1THz. This calls for a more refined model of the device, which we will present here. The RSQUID series resistor is represented as a distributed combination of resistance and inductance, rather than simply a resistor in series with its self inductance. We now include junction capacitance, as the Stewart-McCumber parameter can be close to unity. We treat the RSQUID loop as a co-planar stripline, rather than as an inductor. We report a range of simulations with these enhancements to the model and comment briefly on the results in relation to potential applications of RSQUIDs as active microwave devices.

Index Terms - Superconducting microwave devices, SQUIDs, Josephson oscillators, Josephson mixers, heterodyning.