

TERAHERTZ FLUX-FLOW OSCILLATOR PHASE-LOCKED BY HARMONIC MIXER BASED ON SIS JUNCTION

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We propose a new approach for phase-locking of a Flux Flow Oscillator (FFO) [1] in a superconducting integrated receiver [2, 3]. According to this concept a superconductor-insulator-superconductor (SIS) junction is implemented both for down-conversion of the FFO frequency and for producing the signal to phase-lock the FFO to the external reference by applying the Harmonic Mixer (HM) output directly to the FFO control line. In other words we introduce a new element of superconductive electronics, which is based on the SIS junction and works as a cryogenic harmonic phase detector (CHPD).

For efficient FFO phase-locking the HM output signal is maximized. Value of this signal depends in a complicated way on the HM bias voltage, frequencies and powers of the local oscillator and the FFO signals. We have studied the HM theoretically and compared results of the calculations with experimental measurements. Good qualitative and quantitative correspondence has been achieved.

For demonstration of the FFO phase-locking by the CHPD we have realized a special feedback loop (Fig.1). Such a loop was also integrated on the same chip together with the FFO and the CHPD. The FFO frequency is equal to a harmonic of the local oscillator signal applied to the CHPD. Such a PLL system is expected to be extra wideband due to considerable reduce of the loop length.

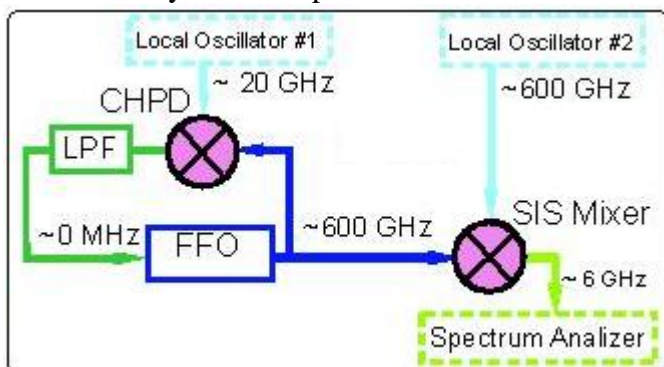


Fig.1. Block diagram. CHPD is used for FFO phase-locking. The SIS Mixer is used for visualization of the FFO radiation line and observed of the synchronization effect.

Presented concept is very promising for building of the multi-pixel SIR array.

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