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Miniaturized Multi-Band HTS Bandpass Filter Design Using Single Perturbed Multimode Resonator with Multi-Transmission Zeros

Jiaming Tang[1,2], Haiwen Liu[1,2], Pin Wen[2], Baoping Ren[2], and Xuehui Guan[2]

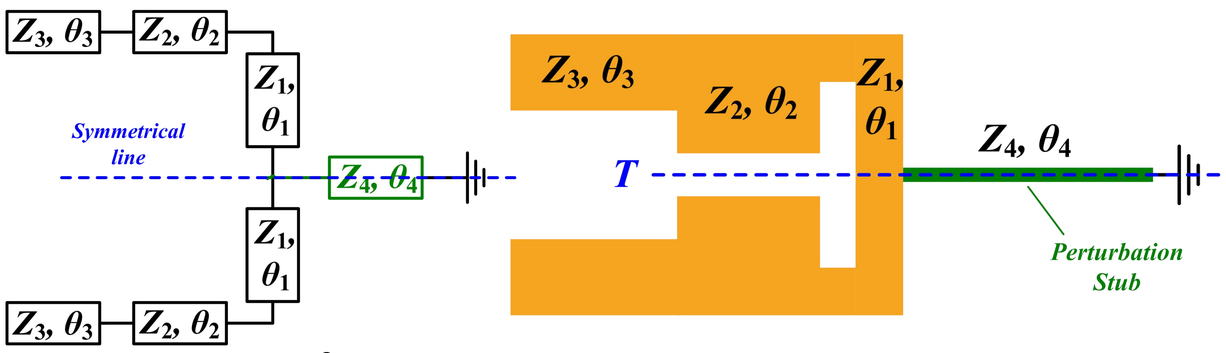
[1]Institute of Electromagnetics and Acoustics and Department of Electronic Science, Xiamen University, Xiamen, China.

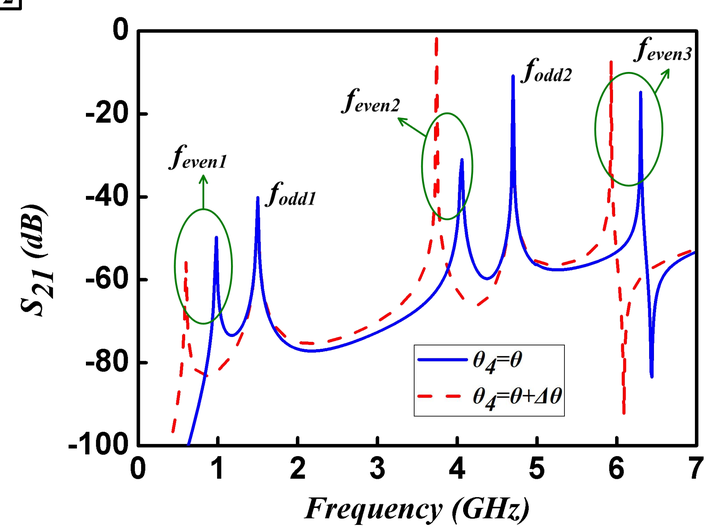
[2]School of Information Engineering, East China Jiaotong University, Nanchang, China.

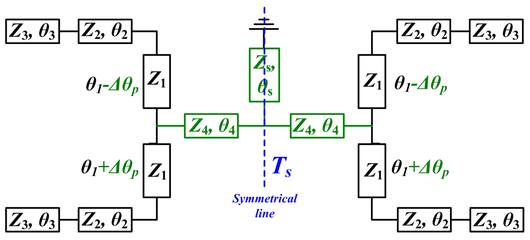
***Abstract*:** Bandpass filters (BPFs) with miniature size, low insertion loss and multi-band operation are in great demand for modern multi-service radar and communication systems. A miniaturized quint-band HTS bandpass filter (BPF) based on a single perturbed multi-mode resonator (PMMR) is presented in this section. By properly adjusting the lengths and position of the perturbation line in PMMR, the intrinsic resonance modes can be controlled, which is advantageous for multi-band design. Source-load (S-L) coupling, spurlines, and matching stubs on feedlines are introduced to improve impedance matching and generate multi-transmission zeros(TZs), so that enhanced isolation and harmonics suppression can be realized. Low insertion loss within each band is obtained by using high-temperature superconducting (HTS) technology. The filter is fabricated on MgO substrate with YBCO thin films, and measured at the temperature of 77 K. The passband measurement is consistent with the simulation, which verifies five passbands located at 0.56*GHz*, 1.52*GHz*, 3.8*GHz*, 4.7*GHz*, and 5.3*GHz* respectively. The corresponding minimum insertion losses are 0.01, 0.2, 0.2, 0.05, and 0.15dB. The proposed HTS BPF owns the great merits of simple structure, miniature size ($0.008\lambda_g^2$) , wide upper stopband, and low insertion loss.

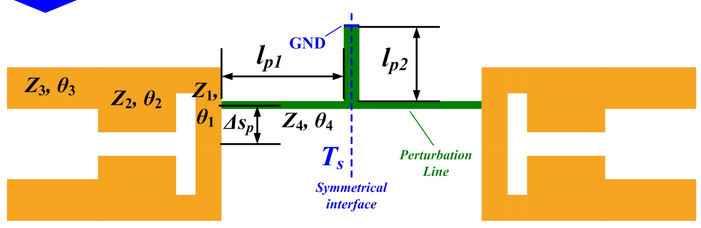
***Key Words*:** Quint-band, perturbed multi-mode resonator (PMMR), miniaturization, multi-transmission zeros, HTS.

Resonator Analysis

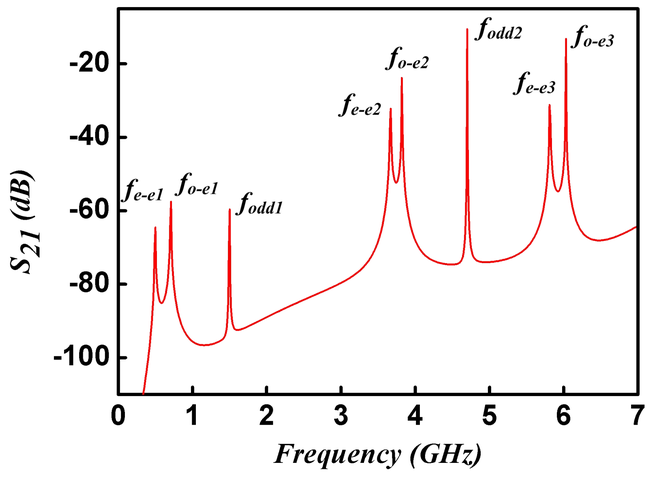




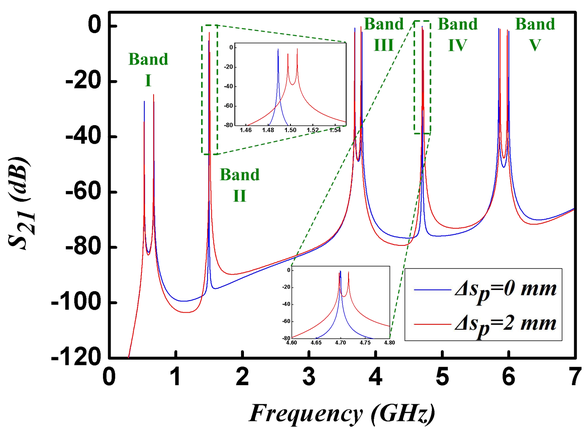


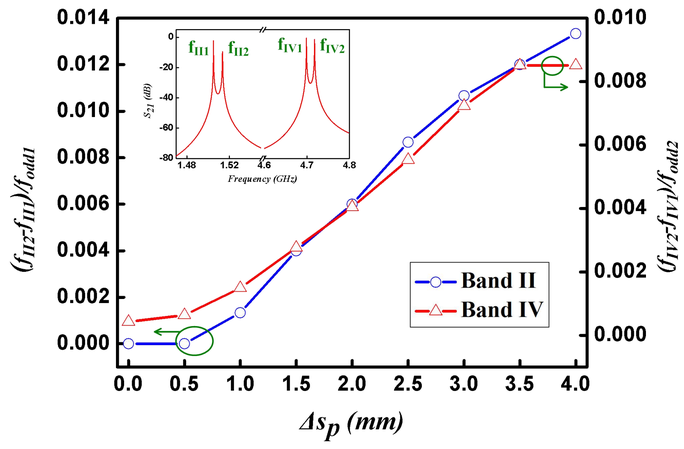


$\Delta\theta_p$=0 (Δs_p=0):

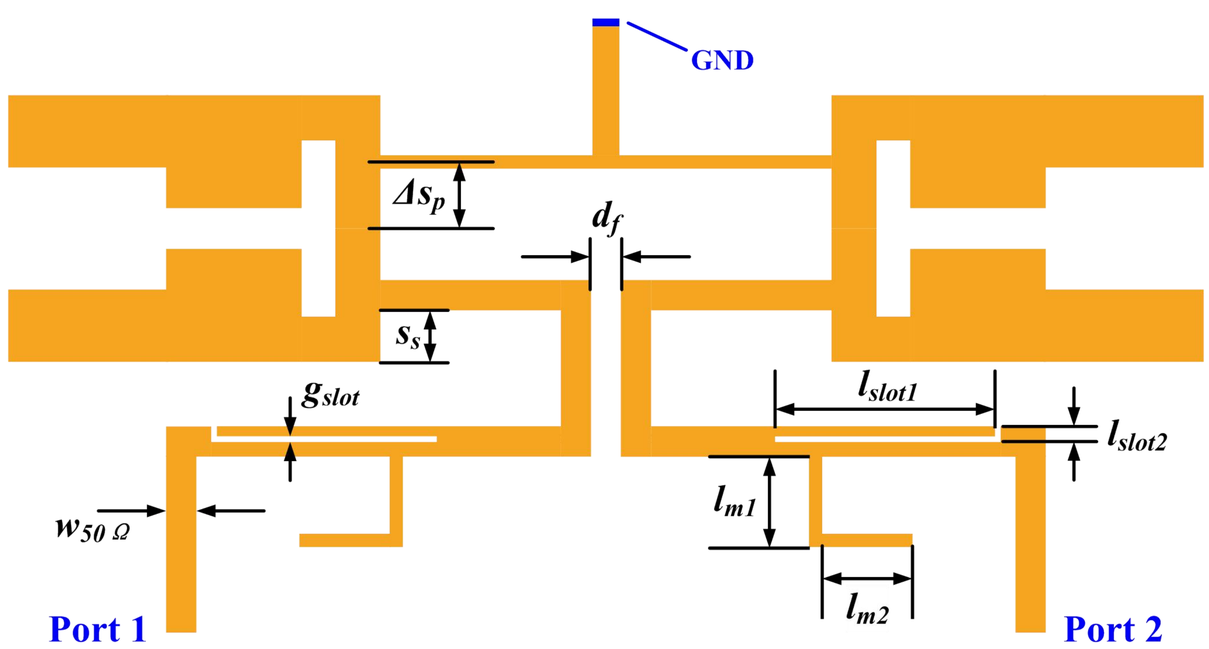


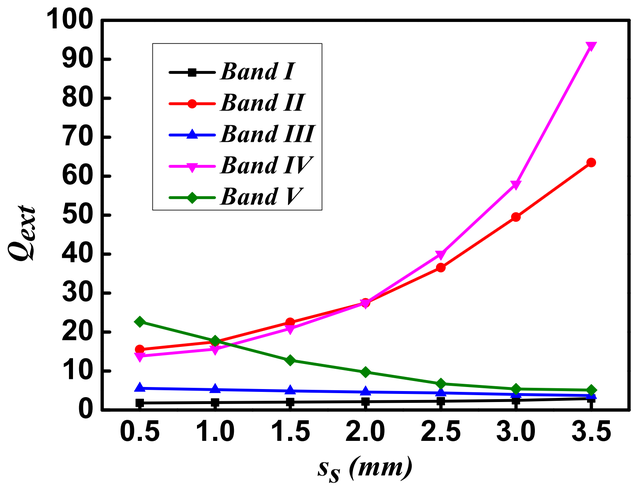
$\Delta\theta_p\neq$0 ($\Delta s_p\neq$ 0):





Filter Design





$$Q_{ext} = \frac{g_0 g_1}{FBW} = \frac{\omega_0}{\Delta\omega_{-3dB}}$$

Q_{ext} values are finally selected as 1.0, 32.5, 7.8, 37.7, 8.2 for band I to band V with s_s=2.42 *mm*.

Fabrication and Results