Monolithic Compact Low-Frequency Bandpass Filter Based on Intertwined Helical Resonators

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STATUS QUO

3D fully metallic structures alternatives

- ✓ 3D printing technologies or additive manufacturing processes.
  - ❖ Stereolithography (SLA).
  - ❖ Fused deposition modeling (FDM).
  - ❖ Selective laser siltering (SLS).

Compact low-frequency bandpass filter

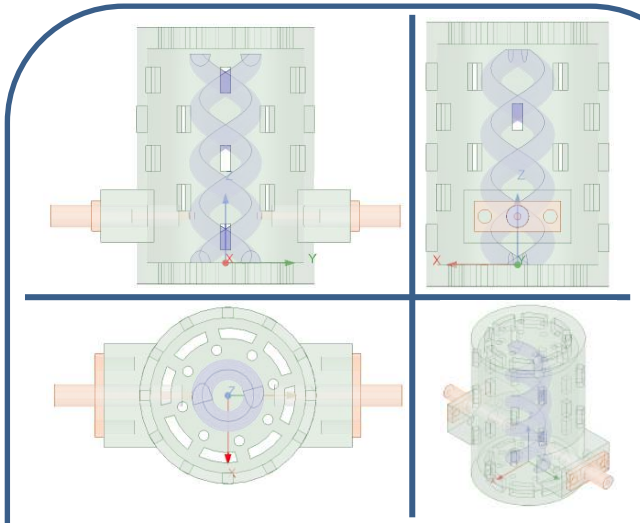
- ✓ Difficulty in the development of low-frequency (< 3GHz) bandpass filters making use of 3D cavity filters → Capacitively-loaded Coaxial cavity resonators → Helical resonators → Intertwined helical resonators

NEW INSIGHTS

Monolithic bandpass filter based on intertwined helical resonators.

- ✓ Monolithically-integrated.
  - ❖ High-precision SLA manufactured complex topology.
- ✓ Intertwined helical resonators.
  - ❖ Novel approach to reduce the size of the bandpass filter one step further than conventional coupled helical resonators.

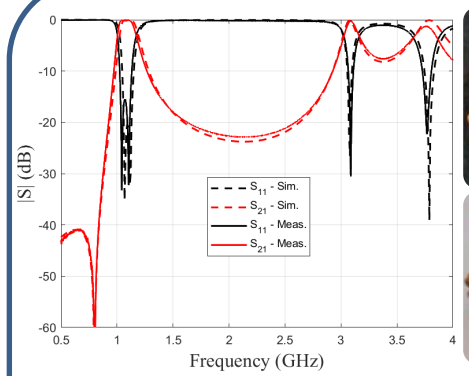
DESCRIPTION



Drawing views of the proposed helical resonator based BPF

- ✓ The proposed second order BPF is composed of two capacitively-loaded intertwined helical resonators that are placed inside a hollow cylindrical cavity.
- ✓ Design based on coupled resonators theory (Q_e and K).
- ✓ Main characteristics:
  - ❖ f_c = 1,08 GHz
  - ❖ 3 dB FBW = 15,5 %
  - ❖ IL = 0,08 dB
  - ❖ 1st Spurious ratio = 2,8
  - ❖ Measured Q_{eff} = 1805
  - ❖ Dimensions ($\lambda_x \times \lambda_y \times \lambda_z$) = 0,12 × 0,12 × 0,18

QUANTITATIVE IMPACT



RF-measured and EM-simulated response of the single-band helical resonator based BPF

Manufactured prototype

PROPOSED CONCEPT GOALS

The future work for this contribution includes:

- ❖ Investigating the impact of expanding the frequency range of the prototype.
- ❖ Exploring the potential for employing the suggested topology in higher order filters.
- ❖ Developing a balanced filter based on the proposed topology.