華中科技大學
Huazhong University of Science and Technology
光学与电子信息学院
School of Optical and Electronic Information
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Design of Six-cavity Ceramic Waveguide Filter with Four Transmission Zeros

Shunliang Meng[1], Fei Liang*[1,2], Zihang Lin[1], Wenzhong Lu[1,2], Xiaochuan Wang[1,2]

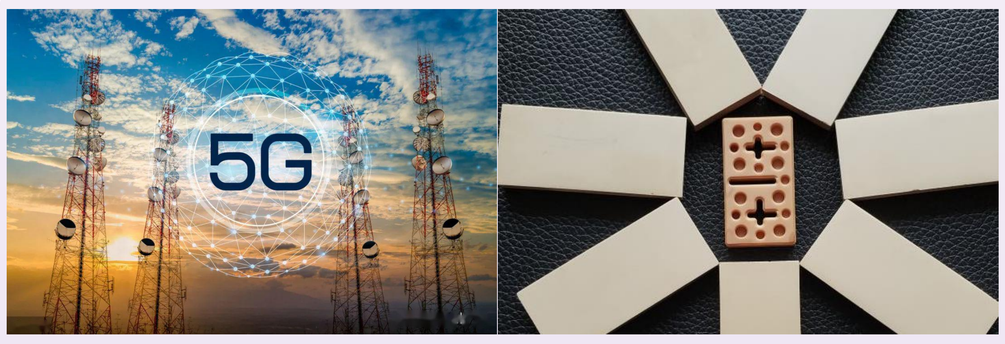
1 School of Optical and Electronic Information, Huazhong University of Science and Technology, Wuhan, China

2 Wenzhou Advanced Manufacturing Technology Research Institute, Huazhong University of Science and Technology, Wenzhou, China

E-mail: liangfei@mail.hust.edu.cn

I. Introduction

- Ceramic waveguide filter has become the mainstream choice for 5G base station filters due to their small size, light weight, low insertion loss, and high rejection.
- In order to enhance the out-of-band suppression characteristics of the filter, it is usually necessary to introduce an appropriate amount of transmission zeros.
- The out-of-band suppression adjustment of the filter can be realized by changing the positions of the transmission zeros.



II. Filter design theory

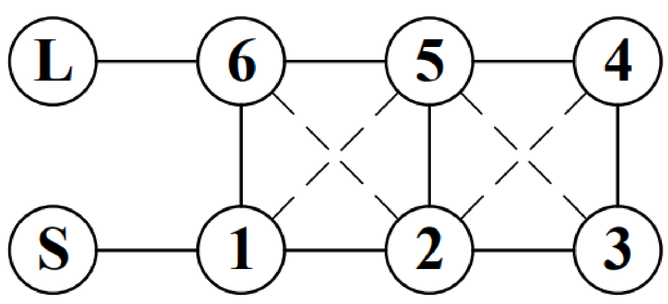


Fig. 1 Topological structure of six-cavity ceramic waveguide filter with four transmission zeros.

$$M = \begin{bmatrix} 0 & 1.036 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1.036 & 0 & 0.866 & 0 & 0 & -0.004 & 0.019 & 0 \\ 0 & 0.866 & 0 & 0.592 & 0.022 & -0.166 & -0.004 & 0 \\ 0 & 0 & 0.592 & 0 & 0.715 & 0.022 & 0 & 0 \\ 0 & 0 & 0.022 & 0.715 & 0 & 0.592 & 0 & 0 \\ 0 & -0.004 & -0.166 & 0.022 & 0.592 & 0 & 0.866 & 0 \\ 0 & 0.019 & -0.004 & 0 & 0 & 0.866 & 0 & 1.036 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.036 & 0 \end{bmatrix}$$

The coupling matrix of six-cavity ceramic waveguide filter with four transmission zeros.

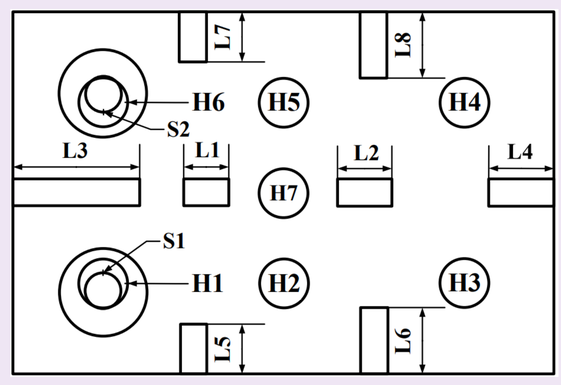


Fig. 2 The structure of a six-cavity ceramic waveguide filter

III. Simulation and optimization of filter

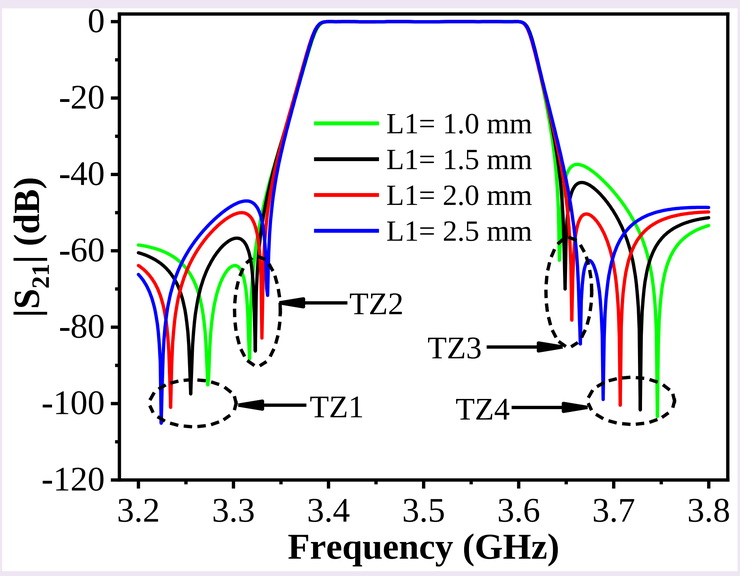


Fig. 3 The relationship curves of the filter |S21| with the change of L1

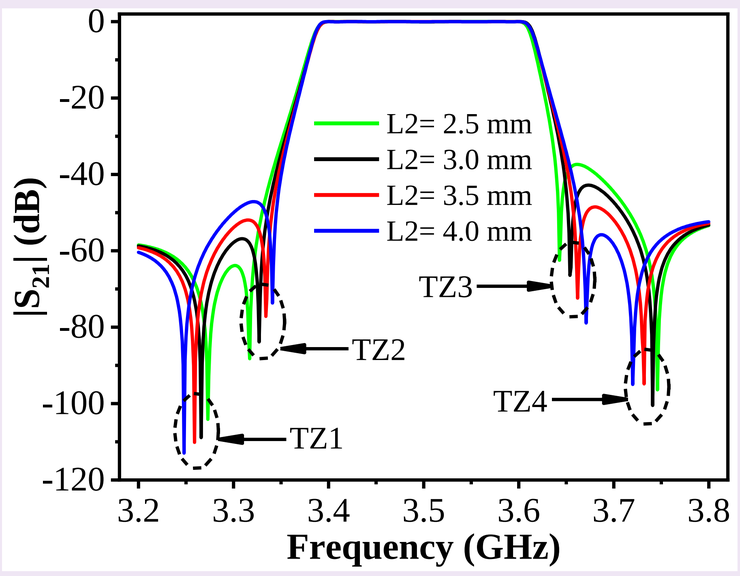


Fig. 4 The relationship curves of the filter |S21| with the change of L2

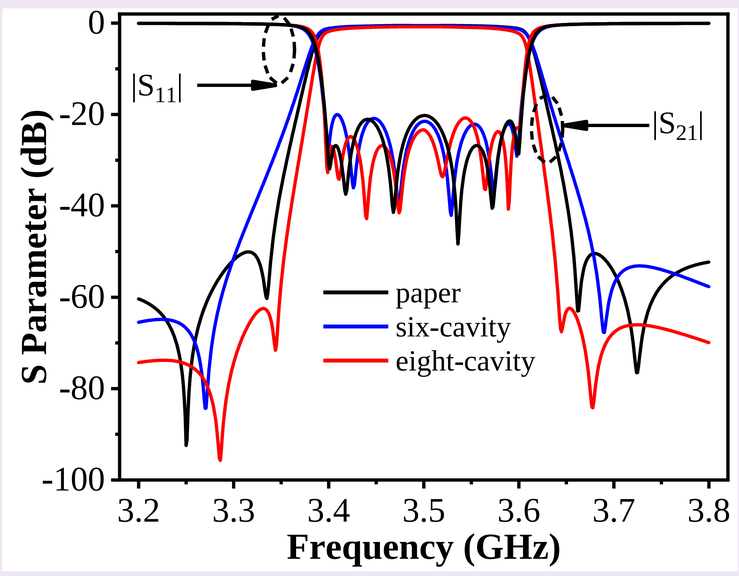


Fig. 5 S parameter curves of different types of ceramic waveguide filters

IV. Conclusions

- By sharing the second, fifth resonant cavities and the capacitive coupling structure between the two cavities, two capacitive CQ coupling units are formed.
- The diagonal coupling is introduced into the CQ unit, and the amount of diagonal coupling is adjusted by changing the length of the through slots L1 and L2, thereby affecting the offset of the transmission zeros' positions.
- As the lengths of the through slots L1 and L2 increase, the transmission zeros TZ1 and TZ4 shift to the low frequency direction, and the transmission zeros TZ2 and TZ3 shift to the high frequency direction.

Acknowledge

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References

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