共面波導雙工器與濾波器之分析與設計

陳俊斌、毛紹綱 ; 林明星

E-mail: 9223465@mail.dyu.edu.tw

摘 要

本論文提出一新的共振器，將其應用於微波頻帶之雙工器，並探討寬邊耦合共面波導及覆背式共面波導濾波器之損耗與抑制二倍中心頻率之頻帶。　　共面波導T型結構訊號線伸入兩旁的接地面，來提供半波長與四分之一波長開路以製造出極點及兩側鄰近的零點，產生具有帶通現象的高Q值共振結構，調整此結構長度則能變化電感值或對地的電容值而改變通帶的中心頻率及其頻寬，結合不同長度的共振器則能產生不同通帶的雙工器，其通帶的插入損耗約在3 dB內，反射損失皆在13 dB以上，雙工器埠1與埠3的隔離度大約在-30 dB。本研究提出之雙工器因只使用一個共振結構來造成通帶，故較傳統微帶線雙工器佔用較小面積，且製作簡單、易與其它微波電路元件整合。 適用於窄頻及低損耗之寬邊濾波器也將在本論文討論。利用全波模擬器萃取出電容與電感矩陣以找出耦合及共振線段長度構成寬邊濾波器，與傳統末端耦合微帶線及共面波導濾波器比較，具有較低的輻射損失。其插入損耗在二倍中心頻率處超過20 dB，而理論與實驗結果十分一致。

關鍵詞 : 雙工器 ; 寬邊耦合 ; 共面波導 ; 覆背式共面波導

目錄

參考文獻

[1] C. P. Wen,“ Coplanar waveguide: A surface strip transmission line suitable for nonreciprocal gyromagnetic device application, ” IEEE Trans. Microwave Theory Tech., vol. MTT-17, pp. 1087-1090, Dec. 1969.

[2] Jia-Sheng Hong, et al.,“ A high-temperature superconducting duplexer for cellular base-station applications, ” IEEE Trans. Microwave Theory and Tech., vol.48, No. 8, pp. 1336-1343, 2000.

[3] Jianyi Zhou and Wei Hong,“ Design of compact microstrip duplexers for 3G mobile communication systems, ” IEEE Antennas and Propagation Society International Symposium, vol.2, pp. 816-819, 2000.

[4] Fei-Ran Yang, Yongxi Qian, Roberto Coccioli, and Tatsuo Itoh,“ Analysis and application of photonic band-gap (PBG) structures for microwave circuits, ” Electromagnetics, pp.241-254, 1999.

[5] Tae-Yeoul Yun and Kai Chang,“ Uniplanar one-dimensional photonic-bandgap structures and resonators, ” IEEE Trans. Microwave Theory and Tech., vol.49, No. 3, pp. 549-553, 2001.

[6] Cedric Quendo, et al.,“ Narrow bandpass filter using dual-behavior resonator, ” IEEE Trans. Microwave Theory and Tech., vol.51, No. 3, pp. 734-743, 2003.

[7] S. G. Mao and M. Y. Chen,“ A novel periodic electromagnetic bandgap structure for finite-width conductor-backed coplanar waveguides, ” IEEE Microwave Wireless Components Lett., vol. 11, pp. 261-263, June 2001.

[8] Mikio Tsuji, Hiroshi Shigesawa, and A. A. Oliner,“ New interesting leakage behavior on coplanar waveguides of finite and infinite widths, ” 1991 IEEE MTT-S Int. Microwave Symp. Dig, pp. 563-566.

[9] Gye-An Lee, et al.,“ Suppression of the CPW leakage in common millimeter-wave flip-chip structures, ” IEEE Microwave Guided Wave Lett., vol. 11, pp. 366-368, Nov. 1998.

[10] Hiroshi Shigesawa, Mikio Tsuji, and A. A. Oliner,“ Conductor-backed slot line and coplanar waveguide: dangers and full-wave analyses, ” in IEEE MTT-S Int. Microwave Symp. Dig., June 1988, pp. 199-202.

[11] Sung-Jin Kim, et al.,“ Suppression of leakage resonance in coplanar MMIC packages using a Si sub-mount layer, ” IEEE Trans. Microwave Theory and Tech., vol.48, pp. 2664-2669, Dec. 2000.

[12] W. E. McKinzie and N. G. Alexopoulos, “ Leakage losses for the dominant mode of conductor-backed coplanar waveguide, ” IEEE Microwave Guided Wave Lett., vol. 2, pp. 65-66, FEB. 1998.
[13] Yaozhong Liu and Tatsuo Itoh, “ Leakage Phenomena in multilayered conductor-backed coplanar waveguide, ” IEEE Microwave and Guided Wave Letter, vol. 3, pp. 426-427, Nov. 1993.
[14] Yaozhong Liu and Tatsuo Itoh, “ Control of leakage in multilayered conductor-backed coplanar structures, ” in IEEE MTT-S Int. Microwave Symp. Dig., 1994, pp. 141-144.
[15] C. Y. Lee, Yaozhong Liu and Tatsuo Itoh, “ Leakage Control in conductor-backed coplanar uniplanar structures, ” in IEEE, 1994, pp. 145-147.
[16] Yaozhong Liu, et al., “ Non-leaky coplanar (NLC) waveguides with conductor backing, ” IEEE Trans. Microwave Theory and Tech., vol.43, pp. 1067-1072, May 1995.
[17] William H. Haydl, “ On the use of vias in conductor-backed coplanar circuits, ” IEEE Trans. Microwave Theory and Tech., vol.50, pp. 1571-1577, Jun. 2002.
[18] J. E. Dally, “ A strip-line directional coupler utilizing a non-homogeneous dielectric medium, ” IEEE Trans. Microwave Theory and Tech., vol., MTT-17, pp. 706-712, Sept. 1969.
[19] C. Nguyen, “ Broadside-coupled coplanar waveguide and their end-coupled bandpass filter application, ” IEEE Trans. Microwave Theory and Tech., vol. 40, pp. 2181-2189, Dec. 1992.
[20] F. L. Lin and R. B. Wu, “ Computations for radiation and surface-wave losses in coplanar waveguide bandpass filter, ” IEEE Trans. Microwave Theory and Tech., vol. 47, pp. 385-389, Apr. 1999.
[21] M. A. Magerko, L. Fan and K. Chang, “ Configuration considerations for multi-layered packaged conductor-backed coplanar waveguide MICs, ” 1994 IEEE MTT-S Int. Microwave Symp. Dig, pp.1697-1700.
[22] J. S. Park, et al., “ A design of the novel coupled-line bandpass filter using defected ground structure with wide stopband performance, ” IEEE Trans. Microwave Theory and Tech., vol. 50, pp. 2037-2043, Sep. 2002.
[23] J. T. Kuo and E. Shih, “ Stepped impedance resonator bandpass filters with tunable transmission zeros and its application to wide stopband design, ” 2002 IEEE MTT-S Int. Microwave Symp. Dig, pp. 1613-1616.
[24] T. Lopetegi, et al., “ New microstrip “ wiggly-line ” filter with spurious passband suppression, ” IEEE Trans. Microwave Theory and Tech., vol. 49, pp. 1593-1597, Sep. 2001.
[25] J. T. Kuo, et al., “ Parallel coupled microstrip filters with suppression of harmonic response, ” IEEE Microwave Wireless Components Lett., vol. 12, pp. 383-385, Oct. 2002.
[26] S. -G. Mao and M. -Y. Chen, “ Propagation characteristics of finite-width conductor-backed coplanar waveguides with periodic electromagnetic bandgap cells, ” IEEE Trans. Microwave Theory and Tech., vol. 50, pp. 2624-2628, Nov. 2002.
[27] V. K. Tripathi, “ Asymmetric coupled transmission lines in an inhomogeneous medium, ” IEEE Trans. Microwave Theory and Tech., vol. MTT-23, pp. 734-739, Sep. 1975.
[28] V. K. Tripathi, “ Equivalent circuits and characteristics of inhomogeneous nonsymmetrical coupled-line two-port circuits, ” IEEE Trans. Microwave Theory and Tech., pp. 140-142, Feb. 1977.
[29] D. M. Pozar, “ Microwave Engineering, ” Addision Wesley, N.Y., 1998.
[30] Sang Soon Oh, et al, “ Duplexer using microwave photonic band gap structure, ” Applied Physics Lett., vol.76, No. 16, pp. 2301-2303, April 2000.
[31] D. K. Cheng, “ Field and Wave Electromagnetics, ” Second Edition, Addision Wesley, 1989.