Reconfigurable RF and Microwave Filters for Interference Mitigation

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This presentation will focus on the use of reconfigurable RF and microwave filters for interference mitigation in next-generation frequency agile systems. Several different types of filters will be presented including novel tunable bandpass filters, reconfigurable notch filters, reconfigurable bandpass filters and reconfigurable bandpass to notch filters. In this presentation we will make the distinction between tunable filters, meaning only center frequency can be changed and reconfigurable filters that provide functionality in addition to center frequency tuning.

Tunable bandpass filters have been available for decades. However, recent advancements in filter design and integration have produced wide tuning range filters with high quality factors [1]. The tradeoff between quality factor, tuning speed and tuning range will be discussed.

Reconfigurable notch filters have also found use as effective means of mitigating RF and microwave interference in communication systems [2]. Traditional tunable notch filters can adjust only the center frequency of the notch response. The filters discussed in this section of presentation can not only tune in center frequency, but also the notch bandwidth and number of notch responses provided by the filter can be adjusted in real time. Furthermore, the effects of Q enhancement techniques and 3 dB bandwidth control will be shown.

Reconfigurable bandpass filters are also another emerging filter technology the will be useful for next-generation systems [3]. Such filters can not only change center frequency but can also change bandwidth and provide one or more tunable transmission zeros for mitigating the effects of large tone interferences around the frequency of interest.

Lastly, a reconfigurable bandpass to notch filter will be presented. This type of filter provides a user selectable bandpass or notch response. Both the bandpass and notch response can tune in center frequency only.

[1] D. Peroulis, "Tunable Filter Technologies for 5G Communications," *2018 IEEE International Electron Devices Meeting (IEDM)*, San Francisco, CA, 2018, pp. 14.6.1-14.6.4.

[2] T. Lee, J. Lee, E. J. Naglich and D. Peroulis, "Octave tunable lumped-element notch filter with resonator-Q-independent zero reflection coefficient," *2014 IEEE MTT-S International Microwave Symposium (IMS2014)*, Tampa, FL, 2014, pp. 1-4.

[3] W. J. Chappell, E. J. Naglich, C. Maxey and A. C. Guyette, "Putting the Radio in “Software-Defined Radio”: Hardware Developments for Adaptable RF Systems," in *Proceedings of the IEEE*, vol. 102, no. 3, pp. 307-320, March 2014.