**Circut power loss reduction by improving subcircuits topology and altering realisation technique**

In this Chapter it is shown that total power loss can be reduced by optimizing circuit`s topology and/or altering the realization technique The approach is investigated on an example of periodic structure type broadband filter. The results of the conducted research have been a subject of one journal paper published in *Internatonal Journal of Electromagnetic Waves and Applications* and two conference papers presented at *Mediterranean Microwave Conference MMS`17* and submitted for *22st International Conference on Microwave, Radar and Wireless Communications MIKON`18*, both under auspice of *Institute of Electrical and Electronics Engineers,* which constitute the Chapter.

The design of high selectivity, pseudo-highpass filters is presented. The proposed circuits utilize a novel semi-distributed-element composite right-left handed unit cell composed of sections of transmission lines and a lumped capacitor. By proper balancing the structure, a very broad operation band can be obtained. Moreover, a single-layer microstrip realization is possible making the unit cell well suitable for low-cost filter realization. The proposed concept has been experimentally verified by the design and measurements of an exemplary pseudo-highpass filter.

Following, a realization of low-loss wideband bandpass filters utilizing a periodic structure approach is presented. The recently developed novel semi-distributed composite right-left handed unit cell is considered and adopted for the design of the proposed filters. It is shown that an appropriate balancing of the structure, i.e. selection of circuit parameters allows for achieving very broad passband. Moreover, a suspended microstrip technique is utilized to reduce total insertion loss of the circuit. The presented approach has been confirmed by realization of an exemplary low-loss wideband bandpass filter. Measured operation band is within 1.0 – 9.4 GHz with total loss ranging between 0.35 to 1.8 dB. The obtained results proved the applicability of the presented approach.

Finally, a novel wideband pseudo-highpass filter is presented. Wideband band-pass unit cells and periodic structure approach is utilized for realization of the filter. Low-losses and circuit properties` control are obtained by the realization of the unit cell using distributed elements only, i.e. transmission line stubs and a coupled-line section as well as the utilization of suspended stripline technique for circuit realization. Theoretical analysis of the unit cell as well as experimental results have been provided. An exemplary manufactured compact low-loss, four-unit-cell filter features 1 - 9 GHz wide fundamental passband with very sharp lower roll-off and minimal insertion losses of 0.24 dB. The obtained results have confirmed the performance of the proposed approach.