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The serially coupled multiple ring resonator filters and Vernier effect

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Abstract

The general characteristics of serially coupled multiple ring resonator (SMRR) filters are analyzed. In this case, the ring resonators of the SMRR have identical perimeters and the coupling coefficients distribution provides passband characteristics with steeper roll-off, flatter top and greater stopband rejection than a single ring resonator. In addition, we have also designed and simulated a nonsymmetric Vernier type of SMRR filters for improving a wide free spectral range (FSR) with different ring radii. To expand the FSR of the SMRR, Vernier filters are determined by the least common multiple of the FSR of individual ring resonators. The improvement in suppression of interstitial resonances is also investigated. A novel derivation of the optical transfer functions in Z-domain of SMRR filters is expressed employing a graphical approach to ring resonators with unequal perimeters that can be represented in signal flow graph diagrams.



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