Abstracts

General Theory and Design of Optimum Quarter-Wave TEM Filters

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The exact synthesis and design of a broad class of quarter-wave TEM mode filters is presented in a three-step procedure. The theory is applicable to all microwave filter forms consisting entirely of a cascade of quarter-wave lines, quarter-wave stubs, and coupled quarter-wave lines. The exact design of many conventional filter forms that heretofore could only be designed using approximate methods is possible using the techniques and functions described. General approximating functions that give the "best" transmission response in a Butterworth or Chebyshev sense are derived. The use of a maximum number of available singularities to augment the filter skirt response leads to a minimum element filter termed "optimum multiple." An optimum multipole design insures the "best" possible response for the minimum element and all corresponding redundant element networks. The designer has the freedom of introducing sufficient redundancy to obtain a design that is practical to construct, but which still realizes the optimum response. Judicious choice of network form often results in improved performance and reduced size in comparison with many conventional filter forms. Design procedures are presented that allow the practical realization of distributed filter networks in the form of quarter-wave lines. A design example and experimental results are given to confirm the theory.

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