values of approximately 18 dB, a rather reasonable number. I would ask the authors to comment on the method used to avoid direct crosstalk from the input to the output, (crosstalk would bypass the complementary bandpass filter) in the data of Fig. 6.

To achieve rejection values of 50 to 60 dB normally requires coupling of each resonant section to a different point along the main line with the distance between the coupling points being selected for proper phase cancellation. Such a technique was presented in [2].

Reply[2] *by J.-R. Qian and W.-C. Zhuang*[3]

The object of our paper [1] is to achieve high rejection values (over 40 dB) in the stopband for a bandstop waveguide filter without requiring many coupling irises along the main waveguide. It is just the distinguished feature against others.

We agree with Mr. Snyder that the obtainable rejection for our filters is determined by the return loss and the orthogonality of the two coupling irises.

The return loss or the reflection from the bandstop filters can be divided into two parts according to the following substitution. When the first and last equations of (3) in [1] are inserted into (8) in [1], it is easy to find that the transmission and reflection coefficients for the bandstop filters shown in Fig. 2(b) in [1] are

$$t' = 1 - \left(jM'_{01}/e_0\right)i'_1 - \left(M'_{n\,n+1}/e_0\right)i'_n$$

$$r' = \left(jM'_{01}/e_0\right)i'_1 - \left(M'_{n\,n+1}/e_0\right)i'_n. \qquad (1)$$

In the case of $\omega = \omega'_p$, the vector diagram for t' and r' is shown in Fig. 1. In order to make the resultant of the two components of r' in (1) equal to a unit vector and $t' = 0$, these two components must be 90° out of phase with each other; therefore i'_1 and i'_n are in phase at frequencies $\omega = \omega'_p$. At the frequencies other than poles in the stopband, i'_1 and i'_n are almost in phase, so that $t' \simeq 0$ and $r' \simeq 1$. At the frequencies in the passbands of the filters, i'_1 and i'_n are almost 90° out of phase with each other, so that the two components of r' cancel out, and then the resultant r' is restricted below a prescribed level.

This is the physical reason why there are poles and zeros in the frequency bands. So the return loss or the reflections of the two coupling irises is not a problem in our filters.

As Mr. Snyder mentioned, the crosstalk may have happened because of imperfections in orthogonality of the two irises. The imperfections cause direct coupling from the input of the bandstop filter to the output. This coupling effect can be taken into account by a bypassing reactance jX_b, which, in parallel to the mutual inductance M'_{01}, directly connects the source e_0 to the load R_0.

Taking account of introducing X_b into Fig. 2(b) in [1], the loop equations for the bandstop filters can be rewritten as (3) in [1],[4] but the element Z in the second column should be in place of $(Z - jM'^2_{01}/X_b)$. This means that the i'_1 loop is detuned and can be easily compensated by adjusting the tuning screw of the first cavity.

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[4]By the way, in [1, eq. (3)], the element $(jM_{1n} - jM'_{01}/2m)$ was misprinted as $(jM_{1n}jM'_{01}/2m)$ and the columns were misaligned

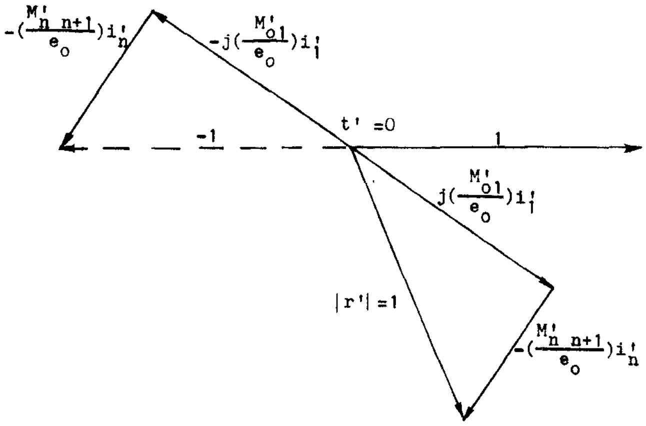

Fig. 1. Vector diagram for t' and r'.

Therefore, as long as $X_b \gg M'_{01}$, the insertion of the X_b has no effect on the accuracy of the theory described in [1], and this has been confirmed by the experiment mentioned before [1].

Even though the high rejection values in the stopbands are obtainable theoretically, the experimental results shown in Fig. 6 in [1] could not be obtained without making the auxiliary experiments with several steps, which ensure the expected values of the parameters R, M's to be carried out and the resonant frequencies of each cavity to be identical.

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Comment on "Fast-Fourier-Transform Method for Calculation of SAR Distributions in Finely Discretized Inhomogeneous Models of Biological Bodies"

ALLEN TAFLOVE, SENIOR MEMBER, IEEE, AND KORADA R. UMASHANKAR, SENIOR MEMBER, IEEE

In the above paper,[1] Borup and Gandhi state in their Section IV that, in addition to their FFT method, "Thus far, the only technique available to compute SAR distributions for models of man is the method of moments (MOM)." In this letter, we would like to point out that there exists a *viable alternative numerical approach* which has been the subject of intense research and numerous publications over the past ten years. In fact, some *nine years ago*, an article in the same MTT TRANSACTIONS [1] discussed the application of this approach to a three-dimensional tissue geometry having 14 079 space cells for purposes of computing the SAR distribution as well as the induced temperatures.

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[1]D. T Borup and O. P Gandhi, *IEEE Trans. Microwave Theory Tech.*, vol. MTT-32, pp 355–360, Apr. 1984.

This approach is called by us the finite-difference time-domain (FD-TD) solution of Maxwell's curl equations. Our publications through the years [1]–[8] have established that FD-TD can accurately model electromagnetic-wave penetration and scattering interactions with complex metal, dielectric, and biological objects. Our most recent work [9] demonstrates high accuracy ($\pm$ 1 dB over a 40-dB dynamic range) in modeling the scattering properties of a *nine-wavelength three-dimensional* scatterer of complex shape. FD-TD models having *in excess of 10^6 space cells* have been successfully run [10].

We wish to call this to the attention of the authors of the above paper so that in future articles they may place their work in proper perspective, and properly inform their readers of the state-of-the-art.

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Comments on "Application of Boundary-Element Method to Electromagnetic Field Problems"

N. MORITA, SENIOR MEMBER, IEEE

The above paper[1] has explained a general formulation of the boundary-element method (BEM) for analyzing two-dimensional electromagnetic fields, and has presented numerical examples for some boundary shapes to show that the BEM is a very powerful numerical method for solving electromagnetic field problems. It gives accurate results with far fewer nodes than the finite-element method, and can also treat field problems in unbounded regions without any additional complications.

I wonder, however, why such an argument is necessary now. The BEM is not a new method, but just the surface integral equation method which has already been proved to be a very useful method in the areas of electromagnetic and other fields. The literature is extensive on the analysis of electromagnetic field problems by integral equations, on discussions of integral equations themselves, on their discretization methods, etc. References [1] and [2] were probably the first to present a practical and numerical technique using integral equations for electromagnetic field problems. Several good books and review papers describing the use of numerical techniques for integral equations have also been published [3]–[6].

The discretization method in the BEM is explained in detail in the above paper.[1] The method shown is, however, just one of many methods now available. It is the one based on the approximation of unknown functions by means of the triangular subsectional functions, which has been proved to be more effective for some cases than the step function approximation [3], [7], [8], [12]. Of course, there are many other better functions to be used depending upon the problem to be solved.

In Section V of the above paper,[1] an integral equation formulation for scattering from dielectric bodies is presented. However, the problem of scattering from material bodies, such as dielectric and gyrotropic bodies, has been treated extensively in the past literature. Various kinds of integral equations for analyzing these problems are now available [9]–[14]. The set of equations given in the above paper[1] is essentially the same as one of those used in the past [11], [15], [16], and can easily be derived using the integral relation on the incident field. In addition, the equation shown is inferior to ones used in the past since the term involving the incident wave is unnecessarily complex. Furthermore, the problem of erroneous resonant solutions involved in these types of equations is not stated at all. The problem of non-uniqueness, which is often associated with simple surface integral equations, has been discussed by many researchers [17]–[22], [13].

I would like to add that the above paper[1] treats only the two-dimensional problems, even though a lot of numerical results have already been given for three-dimensional electromagnetic field problems. (Some of these can be found in the list of References.)

Finally, I don't think that the whole literature on the integral equation formulation can be neglected by using the "anesthetic" by the name of the "boundary-element method," of which only the label is new.

The author wishes to thank Prof. R. F. Harrington for careful reading of the manuscript.

Reply[2] by Shin Kagami and Ichiro Fukai[3]

The authors of the original paper[1] were aware of the previous works on the electromagnetic field analysis using the boundary integral equation method (BIE) and they consider that the

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[1]S. Kagami and I. Fukai, *IEEE Trans Microwave Theory Tech.*, vol MTT-32, pp. 455–461, Apr. 1984.

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