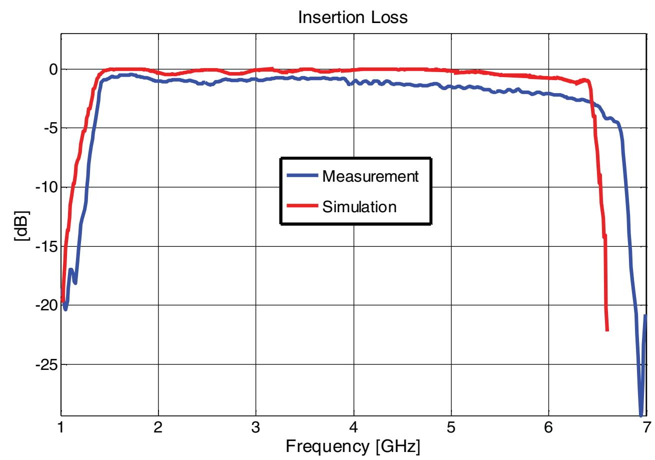

Figure 8 Insertion loss of the filter (measurements and simulations). [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com]

5. CONCLUSIONS

A pseudo high-pass filter of 6th order based on balanced double-sided parallel-strip lines, for which the width of the dielectric layer is equal to the widths of the conducting strips, was presented. Good scattering parameters were achieved as well as good matching between the simulations and measurements. The measured results are close to the theoretical response. This type of filter can be designed and implemented even to higher orders.

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SPECIAL ISSUE ON THE 4TH WORKSHOP ON METAMATERIALS AND SPECIAL MATERIALS FOR ELECTROMAGNETIC APPLICATIONS AND TELECOMMUNICATIONS

GUEST EDITORIAL: SPECIAL ISSUE ON METAMATERIALS AND SPECIAL MATERIALS FOR ELECTROMAGNETIC APPLICATIONS AND TELECOMMUNICATIONS

This Special Issue contains the Proceedings of the 4th Workshop on “Metamaterials and Special Materials for Electromagnetic Applications and TLC” (MMSM08), convened at the University of Naples “Federico II,” Italy, from December 18–19, 2008.

MMSM08 continued the successful tradition, established in 2003 (Florence) and strengthened in 2004 and 2006 (Rome), of a compact forum for discussion of recent results and current trends in a research field that has emerged in the last decade as one of the most promising and rapidly advancing. The interest toward metamaterials and special materials and their strategic importance are witnessed by the steadily growing rate of topical publications, the recent creation of topical journals, conferences and workshops promoted by several scientific societies, a dedicated European PhD program and the European Metamaterial Society (Virtual Institute on Advanced Electromagnetic Materials and Metamaterials), the amount of fundings at international level, and on the number of proposed novel applications based on them.

This edition of the Workshop was organized jointly by the University of Naples “Federico II,” the University of Sannio, and the University of Salerno, in cooperation with the University of Roma Tre, also within the framework of a multi-university project on “Study and Realization of Metamaterials for Electronics and TLC Applications” funded by the Italian Ministry of Education and Scientific Research (PRIN2006 Program). The Workshop was also held jointly with the 15th Microwave Engineering Center for Space Applications (MECSA) National Symposium on “Novel Technologies and Materials: From Microwave Electronics to Optoelectronics.”

This was the first edition after the establishment of the *International Congress on Advanced Electromagnetic Materials in Microwaves and Optics* and, even in this new scenario, the Workshop maintained its appeal, reaching a number of submission (55) that went far beyond the initial expectations. The reasons for such a sustained interest are probably related to the very purpose of the Workshop, that is to bring together a rather “heterogeneous” blend of scientific communities in the fields of electromagnetics, optics, electronics, special materials and nanomaterials, composed of engineers, physicists, material scientists, and chemists. This probably renders the MMSM Workshops unique in their genre.

As in the previous editions, a substantial percentage of submissions (39%) involve Institutions from abroad (with 12 countries represented, from the US to the Far East), either in collaboration with Italian partners (11%) or on their own (28%), resulting in a very interesting technical program, structured in seven oral sessions (with six invited lectures and 24 regular talks) and one poster session (with 25 contributions).

Along the lines of the previous edition (vol. 48, No. 12, Dec. 2006), this Special Issue collects 24 peer-reviewed contributions that address wide-ranging topics, including aspects pertaining to modeling, phenomenologies, experiments, technologies, and applications. More specifically, the topics addressed include photonic crystals and quasicrystals, frequency-selective and high-impedance surfaces, transformation electromagnetics, slow light, semiconductor and polymeric materials, etc. It is hoped that they may provide a representative sample of the latest results and trends, as well as stimulate interdisciplinary exchange in the field.

The guest editors are indebted to all the contributors and to the reviewers, who co-operated by submitting their high-quality manuscripts and rigorous reports within the tight deadlines imposed to ensure timely publication of this Special Issue. Finally, they express their sincere appreciation to the Editor in Chief, Prof. Kai Chang, for his availability and support.

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RESONANT HOMOGENIZATION OF A DIELECTRIC METAMATERIAL

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ABSTRACT: *We investigate numerically and theoretically the homogeneous properties of a metamaterial made of nanorods with a high dielectric constant. The rods have inner resonances leading to an effective magnetic behavior. The influence of various parameters, such as the wavelength, the angle of incidence, and the filling ratio is quantified by means of rigorous numerical computations.* © 2009 Wiley Periodicals, Inc. Microwave Opt Technol Lett 51: 2695–2701, 2009; Published online in Wiley InterScience (www.interscience.wiley.com). DOI 10.1002/mop.24717

Key words: *metamaterials; homogenization; effective properties; artificial magnetism*

1. INTRODUCTION

Metamaterials are artificial objects whose effective electromagnetic properties can be tailored by the properties of the microscopic elements that they are made of [1–6]. Some recent results have even shown the interest of considering nonperiodic arrangement of resonators [7–9]. In general, metamaterials are not used in the usual region of homogenization; that is, whenthe wavelength is much larger than the period of the considered structure. Rather, in most experimental or numerical works the wavelength over period ratio is of the order of unity, which makes it doubtful to use a homogeneous description. In particular, it has been shown that homogeneous and nonhomogeneous effects could indeed be very close to each other [10, 11].

The basic elements of metamaterials can be quite complicated in shape, like the Split Ring Resonators. Deriving the effective properties is thus a theoretical and numerical challenge. In previous articles [12–16], we have derived a rigorous approach to the homogenization of metamaterials made of nanorods with a high dielectric constant. Such a structure is in fact a direct contrast photonic crystal [17]. In the present article, we explore numerically the domain of validity of these theoretical results.

2. HOMOGENIZATION OF PHOTONIC CRYSTALS

We consider the scattering of a monochromatic wave by a bidimensional periodic structure such as that depicted in Figure 1. The permittivity ε_i of the rods is supposed to be very high with respect to the matrix permittivity ε_e, so that they are inner resonances inside them at large wavelengths. We have shown in previous articles that it was possible to describe the structure by homogeneous parameters ε_{hom} and μ_{hom} near the resonances for H$\|$ (magnetic field parallel to the rods) polarization [14–16]. The effective permeability is given by:

$$\mu_{hom}(\omega) = 1 + \omega^2 \sum_p \frac{f_p}{\omega_p^2 - \omega^2} \tag{1}$$

where the oscillator strength f_p depends on the permittivity and shape of the rods and ω_p are the resonant frequencies. The effec-

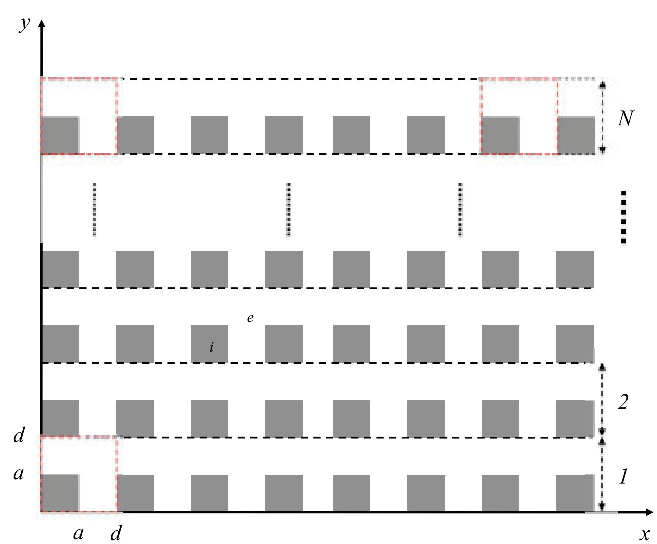

Figure 1 Sketch of the metamaterial. [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com]