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ADAPTIVE PLANAR ANTENNAS ON LATTICES OF ROTATING DIELECTRIC RESONATORS

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АДАПТИВНІ ПЛАНАРНІ АНТЕННИ НА РЕШИТКАХ ОБЕРТОВАНИХ ДІЕЛЕКТРИЧНИХ РЕЗОНАТОРІВ

Досліджуються властивості планарних антен побудованих на решітках обертованих діелектричних резонаторів.

The use of rotating DR in various lattices significantly expands the possibilities of constructing a wide class of devices, antennas, channel switches, multiplexers, and other elements of microwave and optical communication systems [1-3]. The purpose of this report is to investigate antennas built on rotating DRs.

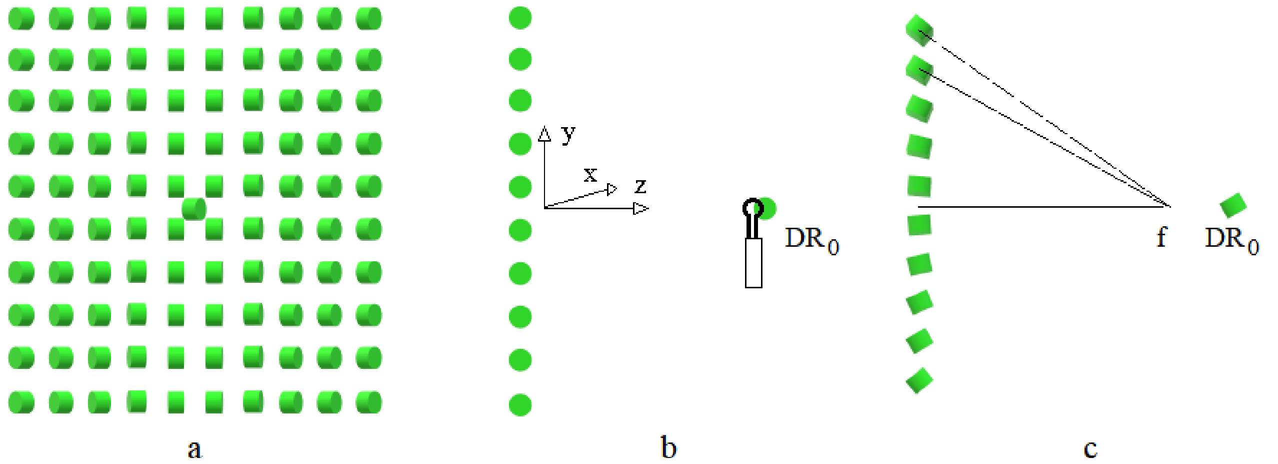
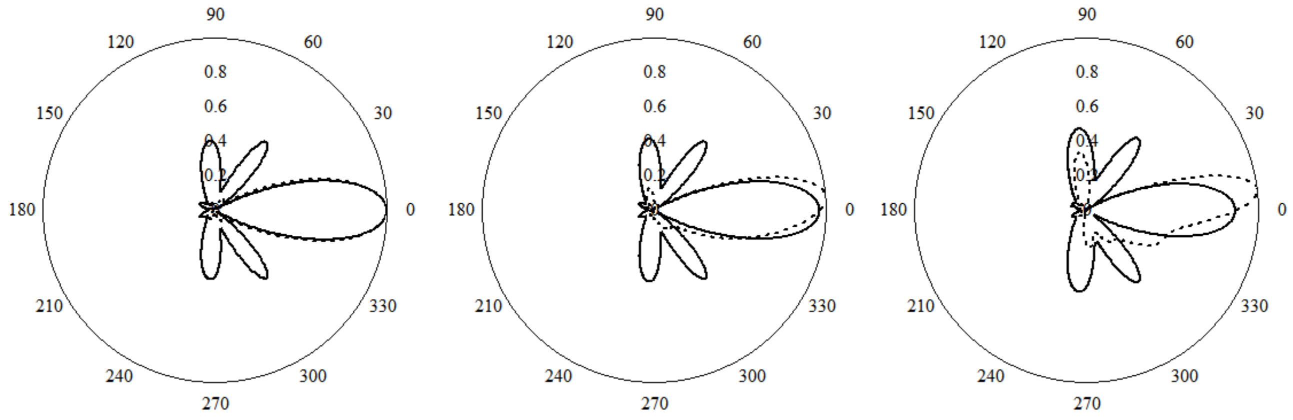


Fig. 1. Planar antenna image on Rotating Cylindrical Dielectric Resonators (a - d).

We investigated the square lattice with a relative distance between the centers $L_x = L_y = 1/4\lambda_0$ of the adjacent resonators (Fig. 1), where λ_0 - is the wavelength in open space. The dimensions of the DR corresponded to the condition of excitation of the main magnetic oscillations in them H_{101}. The dielectric constant of each DR was assumed to be equal $\varepsilon_{1r} = 36$; $\mathrm{tg}\delta = 10^{-3}$; relative sizes $\Delta = L/2r_0 = 0,44$ (Here r_0 - is the radius, L - is the height of the DR).

Active DR_0 was excited by a metal wire loop. Every DR had the ability to rotate about the y-axis (Fig. 1, a - c). In this case, the planes of the lattice rotated with the condition that a focus is formed on the z-axis at a distance f (Fig. 1, c). DR_0 also could rotate at an arbitrary angle relative to the y-axis. The distance between the active resonator did not coincide with the focal length f.



a b c

Fig. 2. Antenna pattern depending on the angle of active DR_0 rotation: $\varphi_0 = 0$ (a); $-0,1\pi$ (b); $-0,2\pi$ (c);.

We have created a lattice model [4], in which the DR mutual coupling coefficients were calculated using formulas taken from [5]. The result of calculating the antenna beam for different orientations of the DRs is shown in Fig. 2. Where φ_0- is the angle between the axis of the DR_0 and the x-axis (Fig. 1, b). In the E-plane, the antenna pattern is shown as a solid line, and in the H-plane as a dashed line.

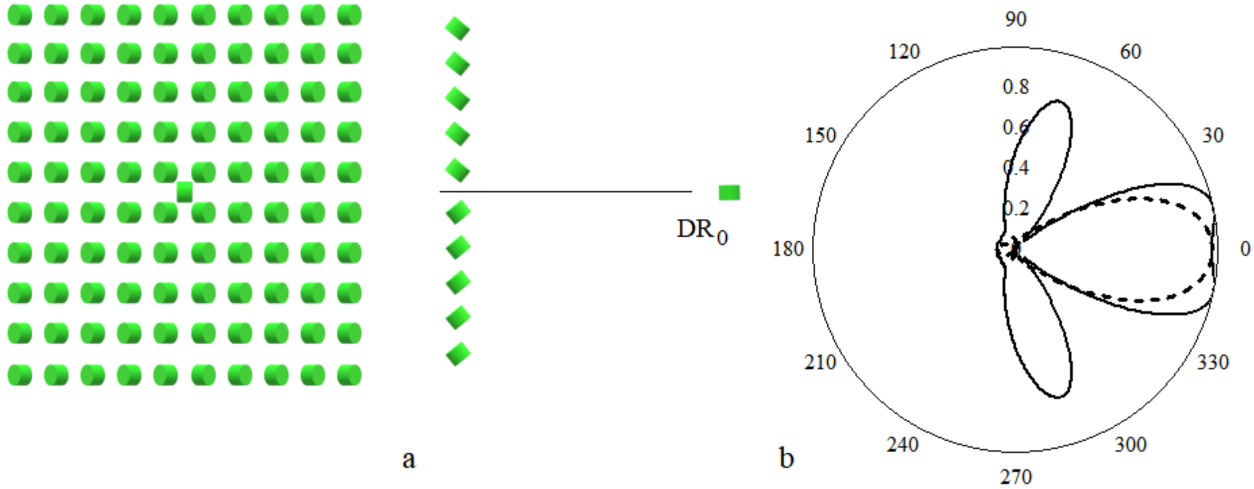


Fig. 3. Planar antenna with semi lattice identical rotation (a).
Antenna pattern depending on the angle of the DR rotation: $\pm 1/6\pi$ (b).

Rotating half of the DR grating (Fig. 3, a) allows expanding the directional pattern in the direction of the main lobe (Fig. 3, b).

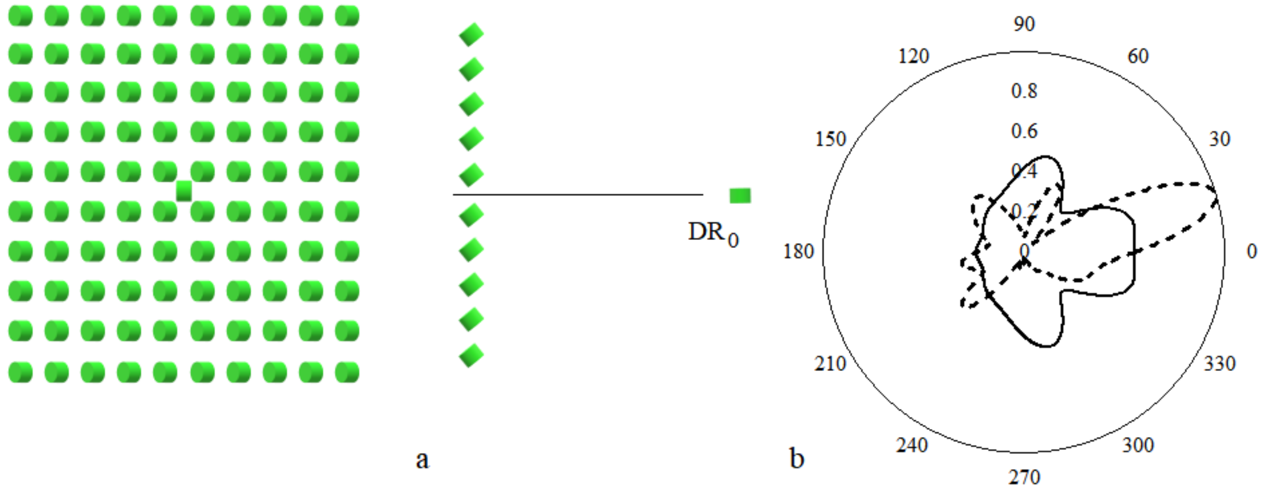


Fig. 4. Planar antenna on Dielectric Resonators with lattice identical rotation (a).
Antenna pattern depending on the angle of lattice DR rotation: $1/3\pi$ (b).

The build an antenna array at the same rotation of the all DRs is shown in Fig. 4. In this case, a change in DR angle has a more noticeable effect on the radiation pattern (Fig. 4, b) rotation.

As follows from the results obtained, the synthesized antennas has good responsiveness of the direction of the main lobe at small angles of rotation of the resonators. The greatest change in the direction of the main lobe is achieved by rotation of all the resonators of the lattice. For small angles, rotation of only the active DR can be applied.

The above results can be used to design adaptive wireless access antennas in microwave, infrared, and optical wavelength communication systems.

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