



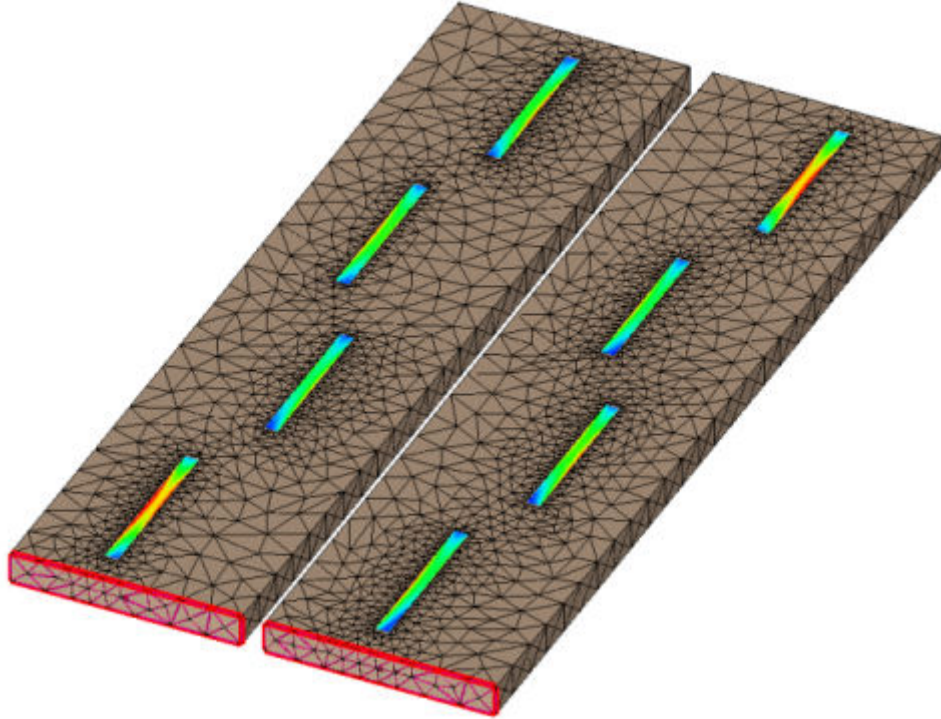
Slotted Waveguide Array

A slotted waveguide array is modeled in FEKO to determine radiation patterns and array efficiency.

The slotted waveguide array is a popular choice for use in radar systems. Slot impedance and resonant behaviour for a single slot are dependent on slot placement and size. In an array environment the impedances are also effected by nearby radiating slots and the task of designing for a specific amplitude distribution (for beam forming purposes) or small reflection becomes complicated. A design procedure for small slot arrays is given in [1] along with a design example for a 2x4 slot antenna array. Here this array is modeled in FEKO to determine the radiation patterns and efficiency of the array.

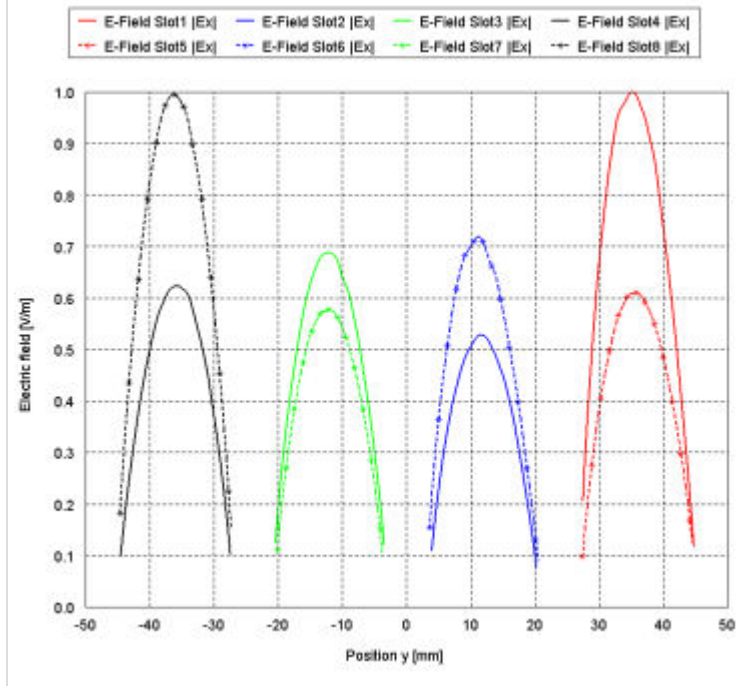
Figure 1 shows the FEKO model of the slotted waveguide array which operates at 8.933 GHz. The two waveguide ports are driven in the TE_{10} mode and in phase. Notice that the mesh is much finer near the slots (edge lengths are about $1/3$ slot width) than for other parts of the structure (where edge lengths are about $1/8$ of a free space wavelength). Also shown in Figure 1 is the electric field strength in the slots (click on the image for a detailed view).

Figure 1: FEKO model of 2x4 slotted waveguide array



Electric field strength in the different slots of the array is also shown in Figure 2. The slot numbering is as in the detailed view of Figure 1. As the electric field is mainly x-directed (along the width of the slot) only this field component is shown.

Figure 2: Electric field in different slots of the array



A comparison between the simulated and published [1] gain patterns is shown in Figure 3. Note that the patterns are in the H-plane and are normalized. The gain pattern of the array is shown in Figure 3 and Figure 4. As there are four slots in the y-direction (H-plane) and only two in the x-direction (E-plane) the main beam in the H-plane is much narrower.

Figure 3: Normalized H-plane gain patterns for slot array

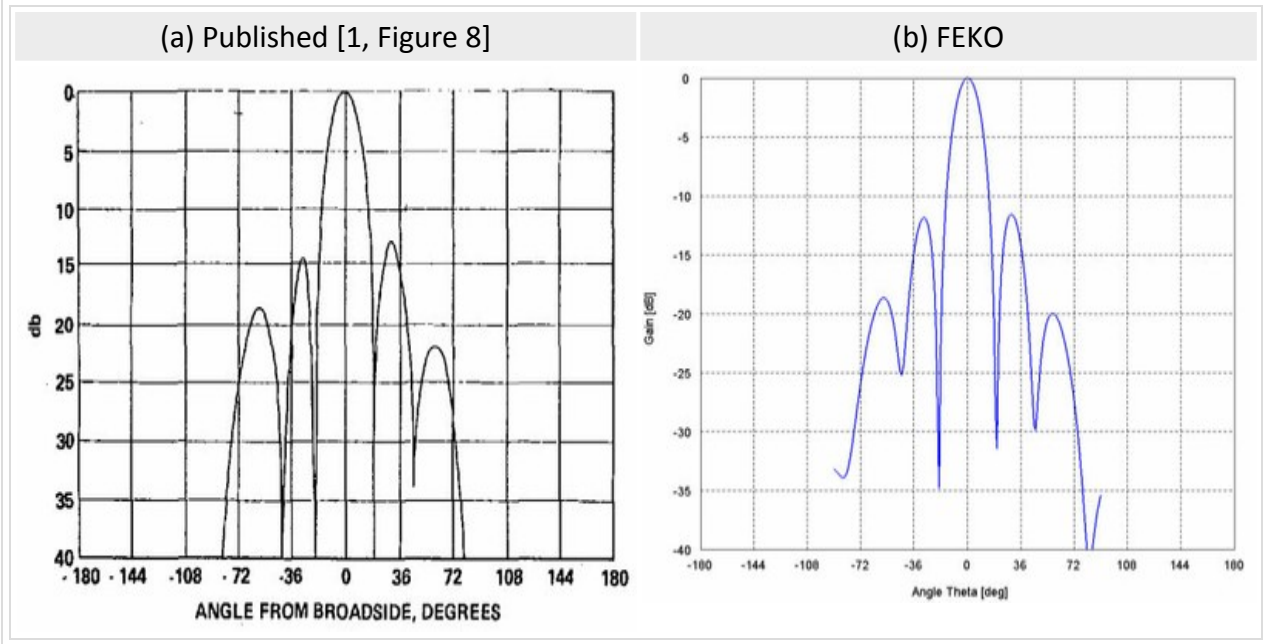
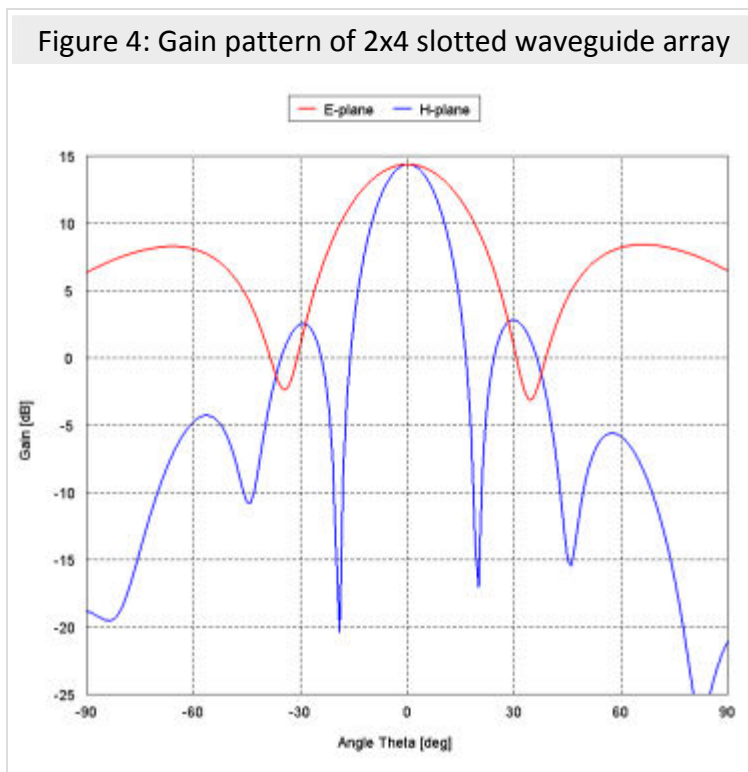
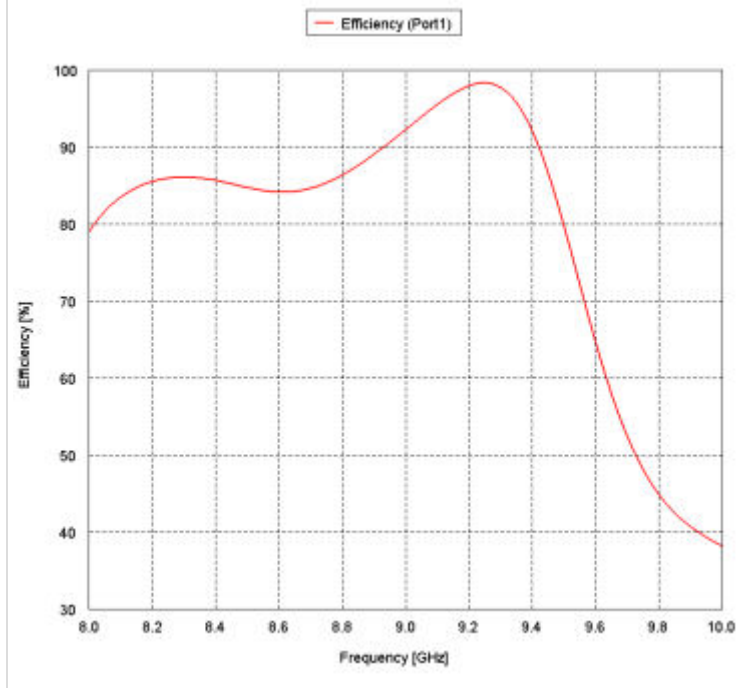


Figure 4: Gain pattern of 2x4 slotted waveguide array



Finally the power efficiency of the array across a range of frequencies is shown in Figure 5. Slotted waveguide arrays are known to exhibit high efficiency and for this array the efficiency is slightly above 90 % at 8.9 GHz and rises to about 98 % at 9.25 GHz.

Figure 5: Efficiency of slotted waveguide array



References

- [1] R.S. Elliot, L.A. Kurtz, "The Design of Small Slot Arrays", IEEE Transactions on Antennas and Propagation, Vol. 26, no. 2, March 1978, pp. 214-219.



www.feko.info



Copyright © 2010 by EM Software & Systems-SA (Pty)