

The Waveguide Slot Array Antenna using Non Resonant Mode to Improve Grating Lobes

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Abstract - There is a slot antenna of the rectangular waveguide as automotive collision avoidance millimeter-wave radar. Are provided a slot antenna to a wide wall, grating Hollow same amplitude as main polarization - Bed occurs. As 38 (GHz) millimeter wave waveguide antenna to be used in, to design the antenna optimized anew the length of slot.

Index Terms — Waveguide slot array antenna, Millimeter wave, 45 degree polarization, Non resonant mode, Grating lobe suppression

1. Introduction

There is a slot antenna of the rectangular waveguide as automotive collision avoidance millimeter-wave radar. Are provided a slot antenna to a wide wall, grating Hollow same amplitude as main polarization - Bed occurs. As 38 (GHz) millimeter wave waveguide antenna to be used in, to design the antenna optimized anew the length of slot.

2. To control phase and amplitude by slot length

The slots length are different from resonant length. Fig.1 shown the length of slots are resonant or non-resonant.

There is a report that realizes dense slot arrangement controls the phase and amplitude. Since the slot spacing can be arranged shorter than the free space wavelength λ , it is possible grating lobe reduction. Whether the same effect in this millimeter-wave band is obtained were calculated by the analysis by the finite element method FEM.

The phase and amplitude of the radiation field from the length of slot and the free space wavelength ratio and slot shown in Fig. 2. Designed center frequency is 38GHz to be millimeter wave band. For example, we choose the length of slot 2.4mm and 5.0 mm, the phase difference is approximately 130 degrees.

Therefore it is possible to arrange the slots opposite phase a position in half length of waveguide length λ as shown in Fig.2.

Ten a long slot 5.0mm, were analyzed 18 this combination is 45 ° polarization millimeter-wave band waveguide slot array antenna short slot 2.4mm. Figure 3 shows the main polarization directivity. It could be obtained directivity grating lobe is suppressed.

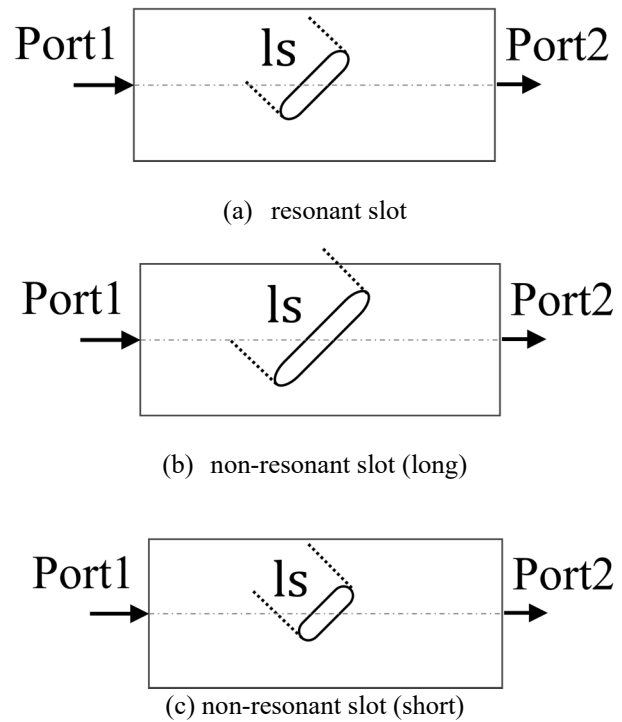


Fig. 1. The structure of non-resonant mode slot.

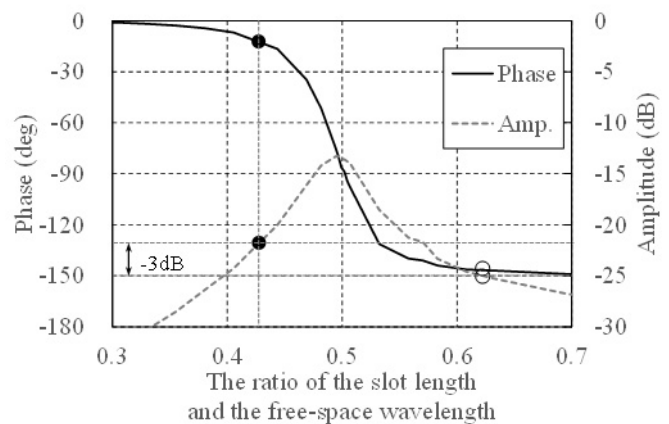


Fig. 2. The length of slots are different to control phase and amplitude.

3. Radiation Pattern

The resonant array model is shown in Fig.3 (a). The resonant slots are arrayed by one lambda waveguide length for equal phase timing. In this case, the distance of each slots is over free space one lambda. So, this slot array antenna has large grating lobes as shown in Fig.4.

We use non-resonant slot pair which almost 130 degree different and radiating amplitude -3dB different. We can reduce the distance of the slots less than one lambda. So, non-resonant slot array antenna achieves to improve grating lobe level. The non-resonant slot pairs array model is shown in Fig.3 (b).

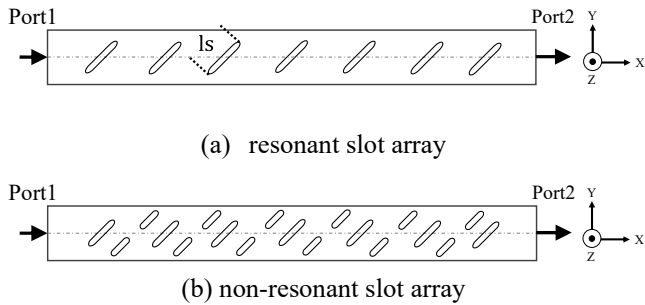
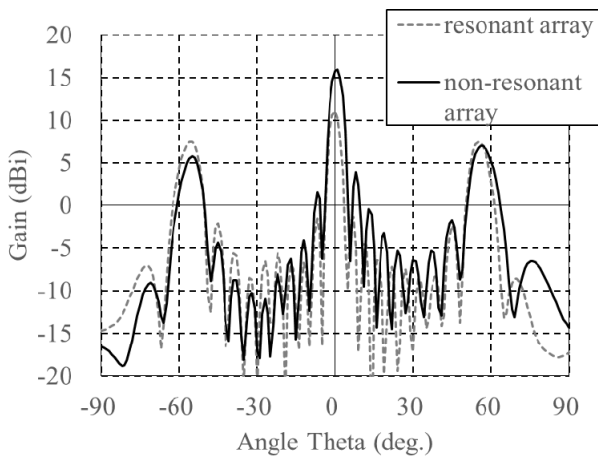
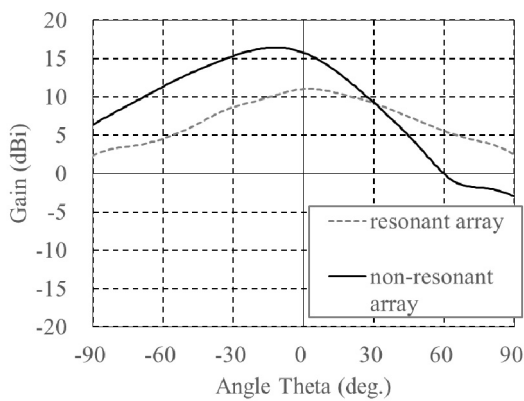


Fig. 3. The structure of slot array antenna.



(a) ZX-plane



(b) XY-plane

Fig. 4. Radiation characteristics

4. Conclusion

The non-resonant slot array antenna is realized to reduce grating lobe level. The slot array that can densely arranged using the change in phase and amplitude according to the length of slot in the millimeter wave band shown by the electromagnetic field analysis.

Future challenges is the comparison between the experiments with the prototype.

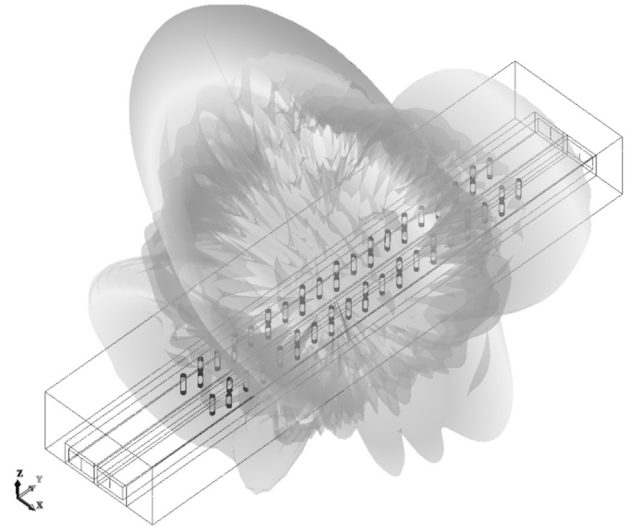


Fig.5 Radiation directivity of the non-resonant slot array antenna of the simulation

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