PHASED-ARRAY ANTENNA BASED ON MEMS FIN-LINE PHASE SHIFTERS FOR W-BAND BEAM-STEERING APPLICATIONS

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This paper presents **phased array antenna, which consists of 21×10 integrated phase shifter elements, as a beam steering device** for automotive radar applications.

Figure 1 demonstrates the concept of the phase shifter based on a bilateral finline bandpass filter with integrated MEMS elements in WR-12 waveguide. One slot is etched in the middle of each fin and 11 MEMS cantilevers are placed across each fin slot to realize the switching function. The phase shifter comprises 22 MEMS switches in total and the phase of the transmitted wave is controlled by the open/close states of these MEMS cantilevers. The best combination of the MEMS switches gives a theoretical, close to, 2-bit resolution. To prove the concept two types of chips (rectangular and X-shape), shown in Figure 2, are fabricated. For each chip type, six different configurations are realized. The phase measurements of fabricated chips are presented in Figure 3. The measured insertion loss is 1.5dB-4dB, and 2dB-4dB for rectangular and X-shape chips, respectively.

To show the automotive radar application, an antenna array shown in Figure 4 is implemented by using waveguide based phase shifters as cells. The maximum measured gain of the antenna array is 16.4dBi at 83 GHz. The antenna arrays ability for beam scanning by moving the feed in E-plane in a plane parallel to the antenna array, with a step equal to the feed aperture size is investigated, also. In this case, all phase shifter are tuned to have maximum radiation at broadside. The antenna array measurement has been done and will be presented at the conference. Phase shifters RF measurement result is close to the expected performance, however, they are not fully functional from MEMS perspective and are fabricated in the fixed programmed states.

REFERENCES:

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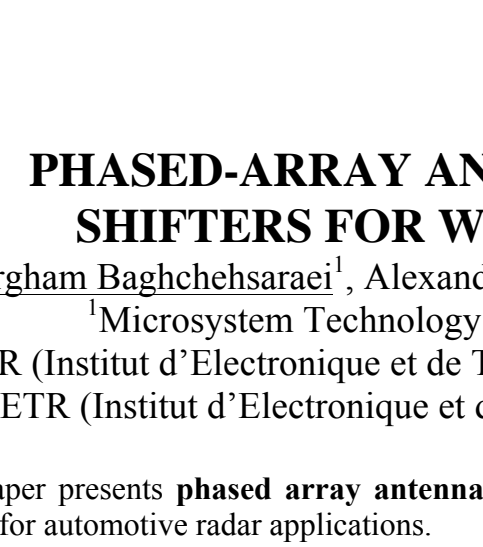

Figure 1: Finline filter: (a) finline chip in WR-12 waveguid, (b) side view of one fin with MEMS.

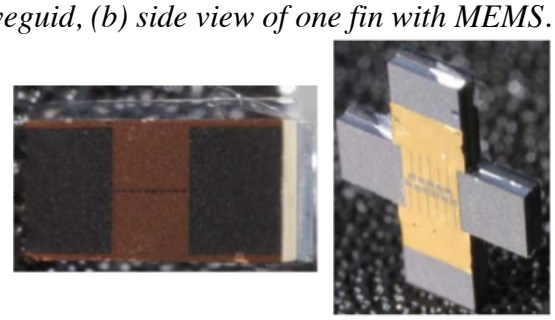

Figure 2: Finline based phase shifter prototypes: (a) rectangular shape, (b) X-shape.

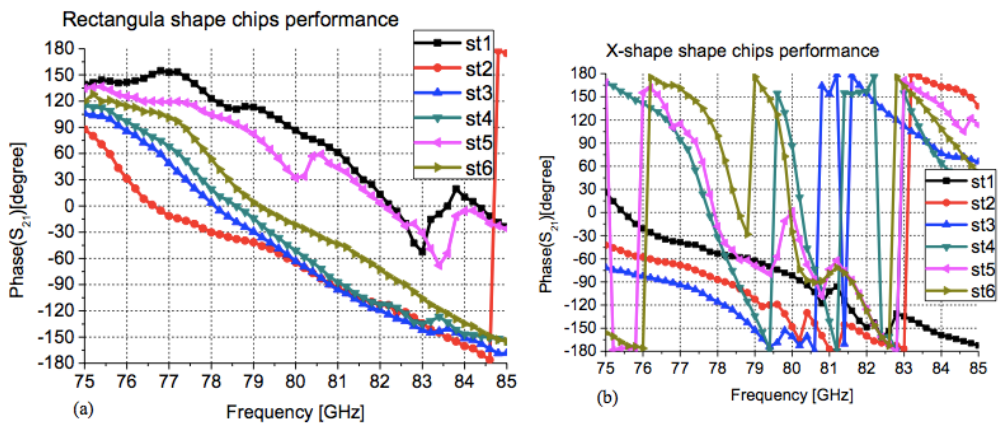

Figure 3: Finline chips phase response: (a) of a rectangular shape chip, and (b) of an X-shape chip.

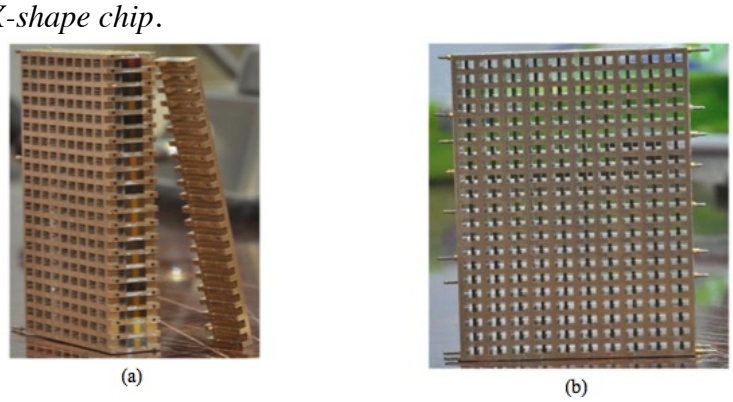

Figure 4: Antenna array assembly: (a) side view, (b) front view.