A PHASED-ARRAY ANTENNA WITH MECHANICALLY CONTROLLABLE MICROWAVE PHASE SHIFTERS

Junho Cha , Yasuo Kuga[26] , Sangil Lee
[1]University of Washington, Department of Electrical Engineering, Seattle, WA 98195-2500
[2]University of Washington, Department of Electrical Engineering, Seattle, WA 98195-2500
[3]Mokpo National University, Electronics Engineering Department, Chonnam, Korea

A low-cost steerable antenna will be essential for the wide adaptation of satellite-based communication systems. The most flexible satellite to ground/airplane communication systems are based on electronic phased-array antenna technology. However, the cost of a phased-array antenna is related to the number of active elements, and thus the present systems are often too expensive for many commercial and military applications. In this paper, we will discuss a new approach which uses a low-cost mechanically controllable microwave phase shifter. By conducting detailed numerical simulations (Ansoft HFSS), we will show that a movable dielectric slab placed close to a coplanar waveguide (CPW) can be used as a phase shifter for a current Milstar Satellite which is operating at 44 GHz for uplink and at 20 GHz for downlink. When the movable dielectric slab was inserted into the gap of a CPW, the effective dielectric constant was calculated as a function of the slab height and the characteristics. In addition, we have simulated the phase shifter using high-resistivity (> 3000 *ohm*.cm) silicon wafers at 20, 40 and 60 GHz. The movable high-dielectric constant slab was added to the CPW. The effective dielectric constant and characteristic impedance was also calculated as a function of slab height. The advantage of silicon wafers as a substrate is that they are easy to integrate and fabricate. When the dielectric slab is added to the CPW, the characteristic impedance also changes which increases reflection. To minimize reflection due to the dielectric slab and obtain the desired phase shift, we need to set the dielectric constant of the slab to be a certain value. We will show that both impedance matching and desired phase shift can be achieved at the chosen frequencies.

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1. (a)
Junho CHA
University of Washington
Department of Electrical Enginee
Box 352500
Seattle, WA
$98195_2500USA$
junho@ee.washington.edu
   (b) 206-616-4374
   (c) 206-543-3842
2. B - Fields and Waves
3. (a)
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