# Design of Singly Curved Conformal Transmitarrays Using a Compact Genetic Algorithm

Marco D. Poort* and Piergiorgio L.E. Uslenghi
Dept. of Electrical and Computer Engineering, University of Illinois at Chicago,
851 S Morgan St, Chicago, Illinois 60607, United States
mpoort2@uic.edu, uslenghi@uic.edu

Conformal and reconfigurable antennas have garnered interest for a wide range of applications such as vehicular antennas, due to their ability to reduce drag and adapt dynamically to the environment. These systems however are difficult to design due to their complex geometric shape, which may inhibit the use of convex optimization techniques. This work overcomes this obstacle by utilizing a compact genetic algorithm (cGA). The cGA is a heuristic optimization technique, meaning that optimal results are not guaranteed; however, the algorithm may be applied to a wide range of surfaces.

The work begins by introducing the antenna geometry, which consists of a fixed pattern of gaps located on a singly curved convex surface and illuminated by a single waveguide feed. The gaps are then switched on and off to alter the radiated pattern. A mathematical model is developed in the phasor domain with a time dependence factor $\exp(+j\omega t)$ omitted throughout. This mathematical model is able to approximate rapidly the far-field pattern for a given excitation of the gaps, and is then used to compute the fitness function for the cGA. The fitness function may be altered to apply the cGA to a variety of design criteria such as beam steering or pattern synthesis.

The cGA is implemented using Matlab and results are demonstrated for maximum directivity beam steering using a variety of surfaces such as circular or parabolic cylinders. These results are then verified through computational simulations. Lastly, present limitations of the mathematical model and issues arising from doubly curved surfaces are discussed.