

## ANALYSIS OF THE DYNAMICS OF COUPLED OSCILLATOR ARRAYS FOR ARRAY BEAMSTEERING

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It has been shown both theoretically and experimentally that a linear array of oscillators coupled appropriately to each other can be used to control the phase distribution in the aperture of a phased array antenna in a simple and convenient manner. [R. A. York, IEEE Trans., MTT-41, pp.1799-1809][P. Liao and R. A. York, IEEE Trans., MTT-41, pp. 1810-1815] One can steer the beam by tuning the oscillators at the ends of the array. It has further been shown that the steady state behavior of such oscillator arrays can be approximately described by Poisson's equation leading to an electrostatics analog in which the oscillator tuning plays the role of charge and the aperture phase is analogous to electrostatic potential. [R. J. Pogorzelski and R. A. York, IEEE AP-S Symposium Digest, Montreal, Canada, July 1997, pp. 324-327.] This analog is based on a continuum model of the array wherein the number of oscillators approaches infinity.

In the present work we use the continuum model to study the dynamic behavior of the oscillator array when an injection signal having a time dependent frequency is applied for modulation purposes. We have found that the time dependent behavior of the array is governed by a Schroedinger type equation in which the potential is determined by the injection signal. We have solved this equation in the case of an injection signal applied to the center oscillator of both infinite length and finite length arrays. In the present case the injection signal frequency is a step function but other functions can be accommodated within the theory. With the step function frequency, the solution for the infinite array has the property that the frequency of each of the oscillators approaches the injection frequency as time approaches infinity but the phase deviation from that of the injection signal increases without limit. In the case of the finite array, however, both the frequency and phase reach steady state values. Moreover, the steady state phase distribution is consistent with the results previously obtained using Poisson's equation.