Periodic Arrays for Frequency-Based Beam Steering (#4716)

An effective way of directing energy in specified directions without the need for individual control of array components

Georgia Tech inventors have created an effective way of directing energy in specified directions without the need for individual control of array components (contrary to typical ultrasonic sources) through the use of periodic source arrays. Beam steering of energy propagated from an array is achieved by exploiting interference phenomena (i.e., constructive and/or destructive interference) generated by spatial periodicity of the array and the simultaneous activation of its components. Such interference phenomena produce waves with frequency dependent directional characteristics, which allow directional scanning to be performed simply through a frequency sweep. As such, the need for beam-forming algorithms and associated hardware may be avoided. In addition, spatially periodic piezoelectric actuators used in some embodiments can be exploited for tuning the excitation to a specific wave mode and, therefore, may be able to combine mode tuning with beam steering capabilities in a single device.

Benefits/Advantages

- Avoids individual control of array components
- Reduced cost, smaller design equipment

Potential Commercial Applications

- Nondestructive evaluation of structures and materials
- Ultrasound medical imaging
- Miniaturized electromagnetic trans-receivers for wireless communication

Background/Context for This Invention

The effective interrogation of the health of a structural component often requires sensors and actuators with the ability to perform directional scanning. This enhances the sensitivity of the inspection and simplifies the determination of the location of damage. In this regard, the application of piezoelectric phased arrays for guided waves-based structural health monitoring has been investigated. However, a perceived underlying limitation of such monitoring is associated with the need to excite array components individually, which involves hardware and/or software complexity.

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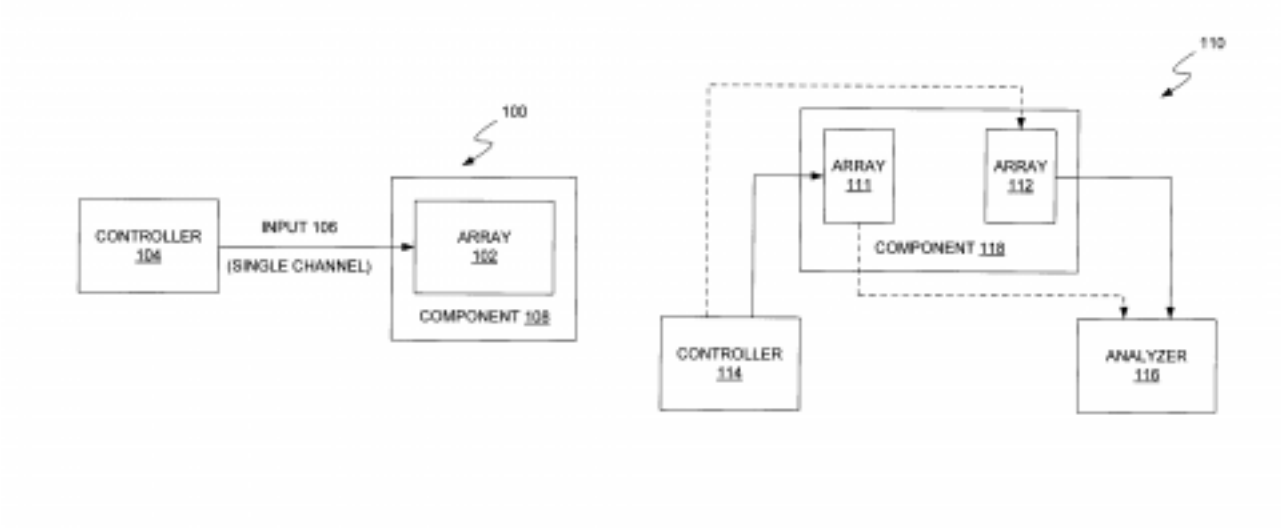

For more information about this technology, please visit:
https://industry.gatech.edu/technology/periodic-arrays-frequency-based-beam-steering