Active EMI Cancellation Approach

David R. Jackson
Dept. of Electrical and Computer Engineering, Univ. of Houston, Houston, TX, USA

Co-authors:

Vani Vellanki[1], Daniel Onofrei[2], and Sohini Sengupta[3]
(1) Dept. of Electrical and Computer Engineering, Univ. of Houston, Houston, TX, USA
(2) Dept. of Mathematics, Univ. of Houston, Houston, TX, USA
(3) Sonos, Santa Barbara, CA, USA

Outline

- What is active EMI (electromagnetic interference) cancellation? Can it really work?
- Some preliminary results
  - Reducing scattered fields from an object*
  - Creating a quiet "protected" region

***Reference:**

S. Sengupta, H. Council, D. R. Jackson, and D. Onofrei, "Active Radar Cross Section Reduction of an Object using Microstrip Antennas," *Radio Science*, vol. 55, issue 2, Feb. 2020.

What is Active Cancellation?

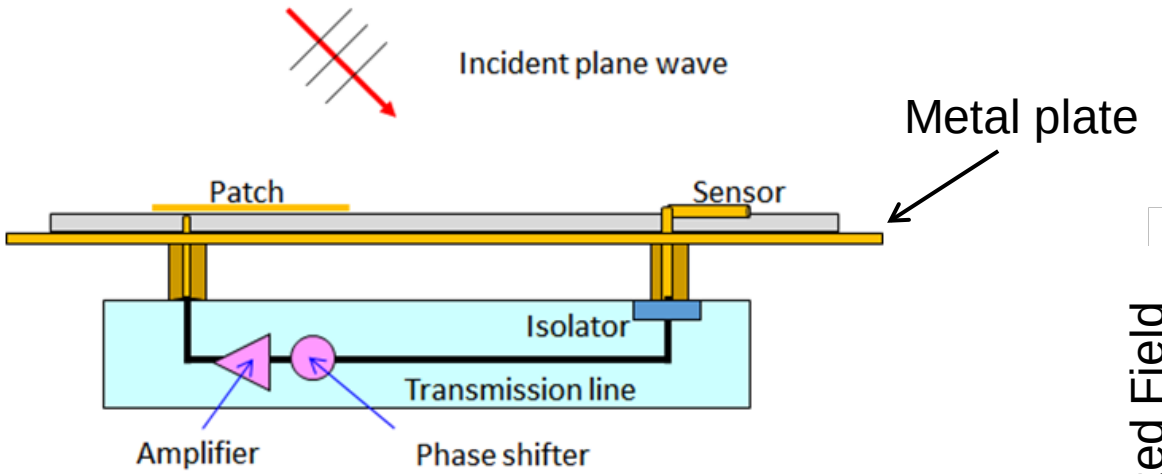
- We all know about noise-cancelling headphones

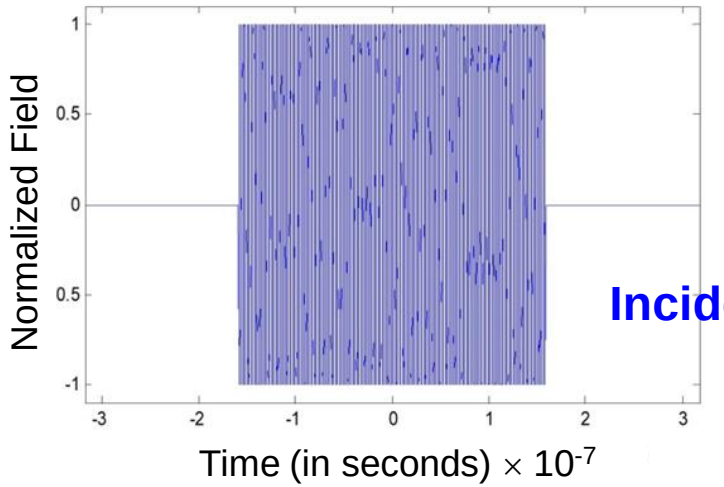
- A cancelling signal is produced to cancel the incoming (interfering) signal)

Question: Can this work for RF signals to reduce EMI (electromagnetic interference)?

Reducing EM Scattering From an Object

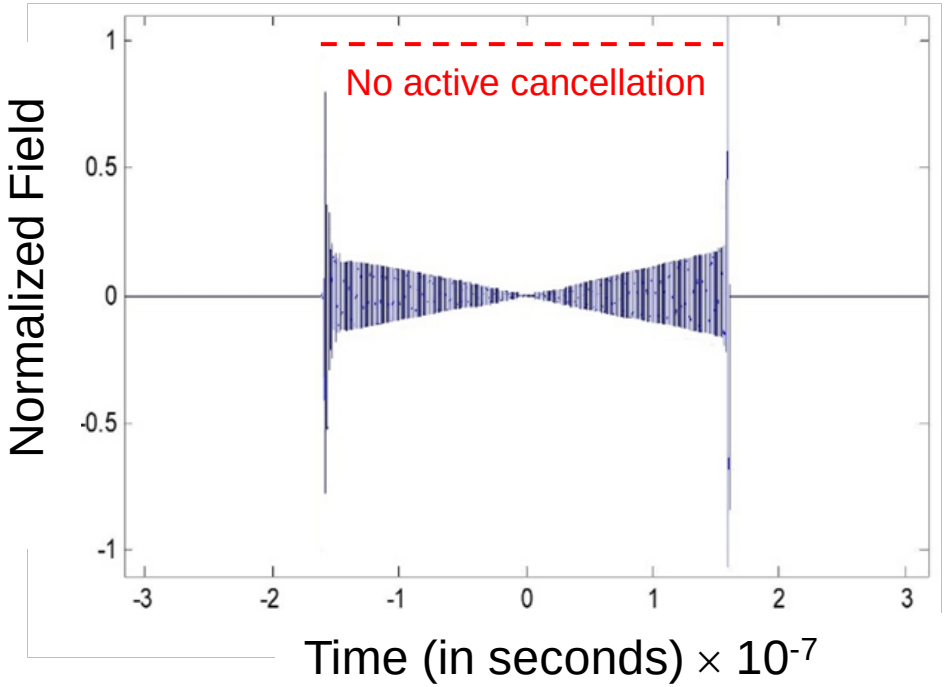
- A simulation is done for a simple object (metal plate) to test the concept.





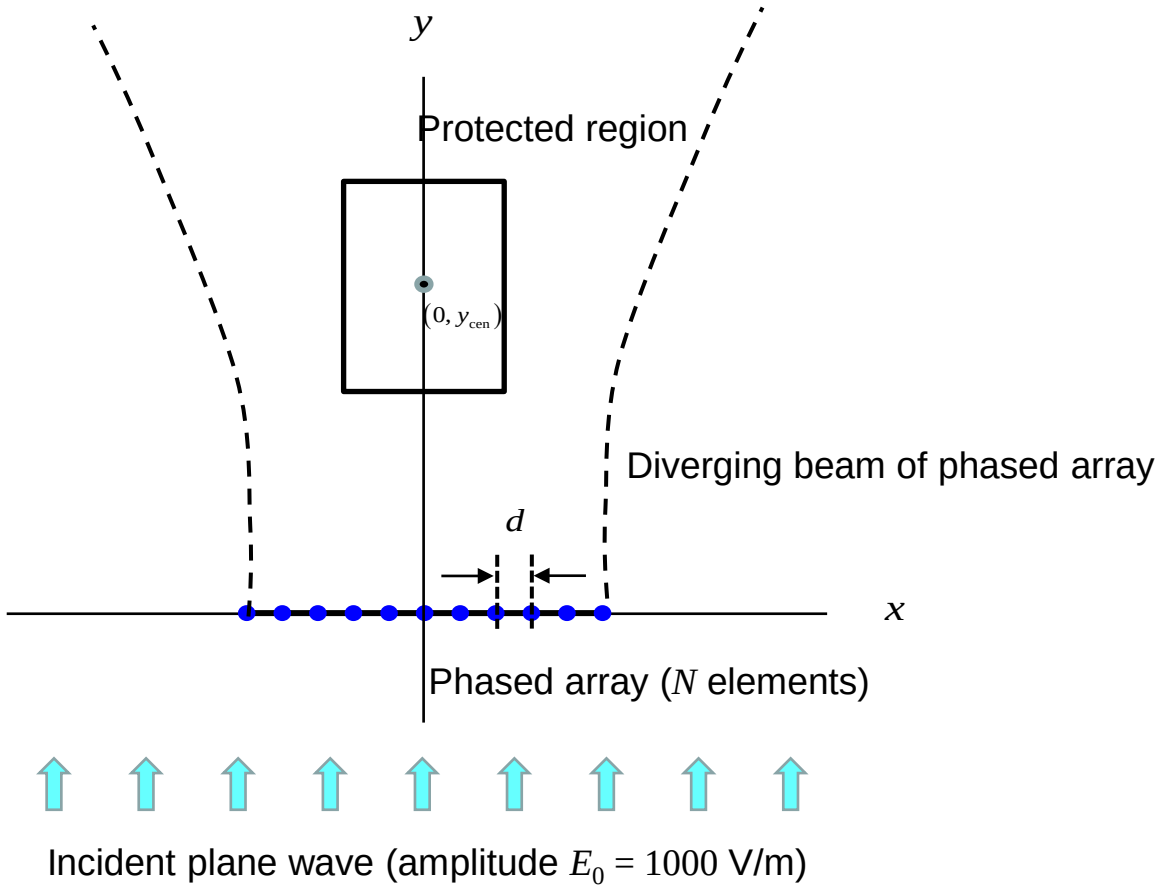
Incident Field

Scattered Field



Creating an EM Quiet Zone

- A simulation is done at a single frequency to test the concept.



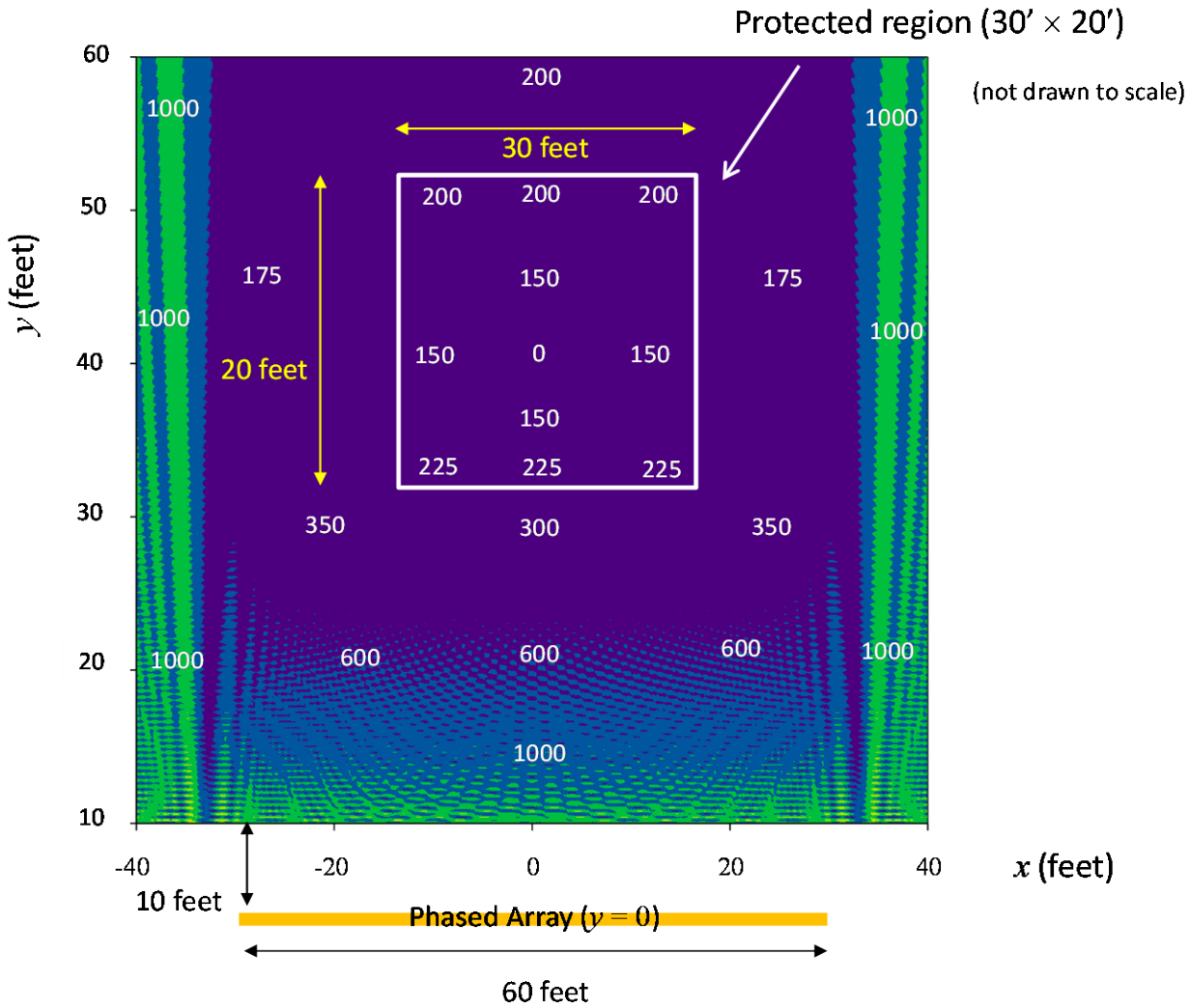
Parameters:

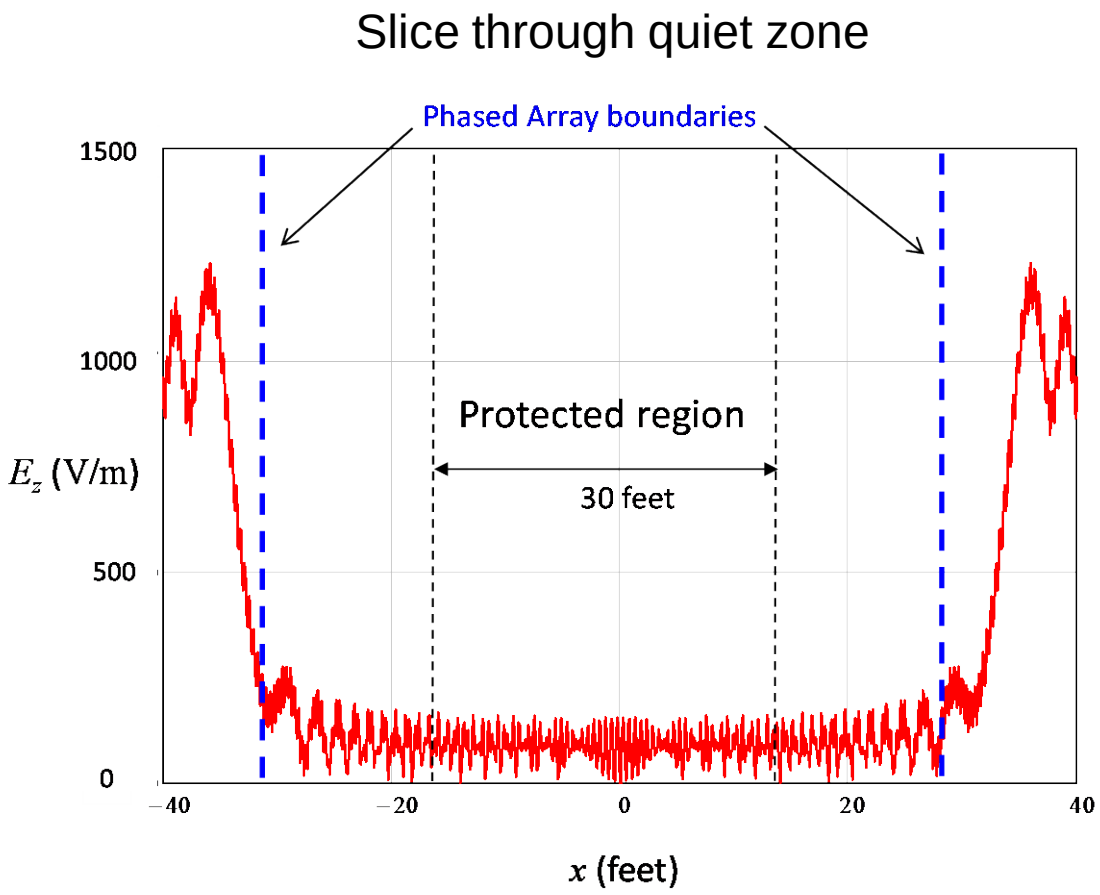
f = 3.0 GHz
N = 201
$d = \lambda_0$ = 0.1 meters
E_0 = 1000 [V/m]
y_{cen} = 40 feet

Array width = 60 feet

Creating an EM Quiet Zone

- A simulation is done (at a single frequency) to see if a quiet zone can be produced.





Conclusions

- Active cancellation may be a tool that can augment existing strategies for EMI reduction.
- The method can potentially be used in different ways:
  - Reducing the scattering from an object, which causes interference.
  - Cancelling the signal from a direct incident wave, creating a “quiet zone”.
- For a time-varying signal the method is not perfect, since we are trying to cancel an EM signal (which travels at the speed of light) with electronics that also operates at the speed of light.

Thank you !

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