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Motivation and Objective

- The design of electromagnetic absorbers is a complicated task. An ideal design would
 - Suppress reflections by matching
 - Absorb waves with lossy materials
 - Make absorber as thin as possible
- The third goal conflicts with the other two
- Genetic algorithms are well suited for the task
 - Enormous success on unintuitive problems
 - Pareto instantiation allows for optimization of conflicting goals

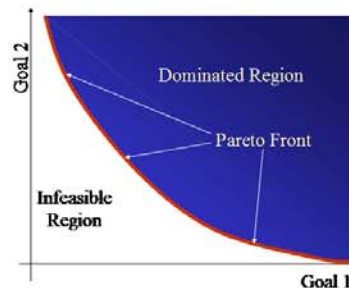
Genetic Algorithms

- GAs are optimization algorithms based on Darwin's Theory of Evolution.
- Advantages of GAs: They
 - Tend to find global or strong local optima
 - Work without derivatives
 - Work with both continuous and discrete variables
 - Are simple to parallelize.
- GAs have designed of the turbines of the Boeing 777 engine, written music, played the stock market, and designed countless other devices in all disciplines of engineering.

Pareto Genetic Algorithms

- The GAs used here are actually Pareto genetic algorithms (PGAs)
- They return a set of optimal designs that are the best tradeoffs between different design goals
- A design is **Pareto optimal** if no design exists that is better in all respects
- The **Pareto front** is the set of all Pareto optimal designs
- Given the Pareto front, the choice of design to actually use is an executive decision

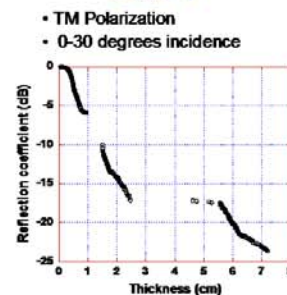
Pareto Genetic Algorithms(2)



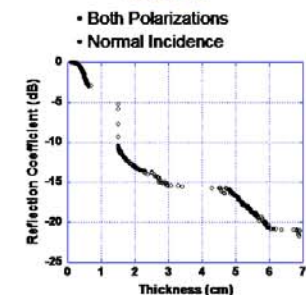
General Approach

- The fitness of each design is computed using the objective function.
- The objective function uses Finite Elements-Boundary Integral Method (FE-BI) to compute the absorption coefficient of a design.
- On the basis of their fitness values, the chromosomes are processed by the Genetic Algorithm to obtain optimized designs.
- Four different samples of absorbers have been used, with varying degrees of loss.
- The behavior of the absorber for a range of incidence angles have been simulated for a band of 3-18 GHz.

Case 1



Case 2



Acknowledgements

This work is supported by the Office of Naval Research through the Advanced Materials Intelligent Processing Center program.