

Time reversal communications

Arnold D. Kim

School of Natural Sciences

University of California, Merced

email: adkim@ucmerced.edu

web: <http://faculty.ucmerced.edu/adkim>

Claim. *UC Merced exists*



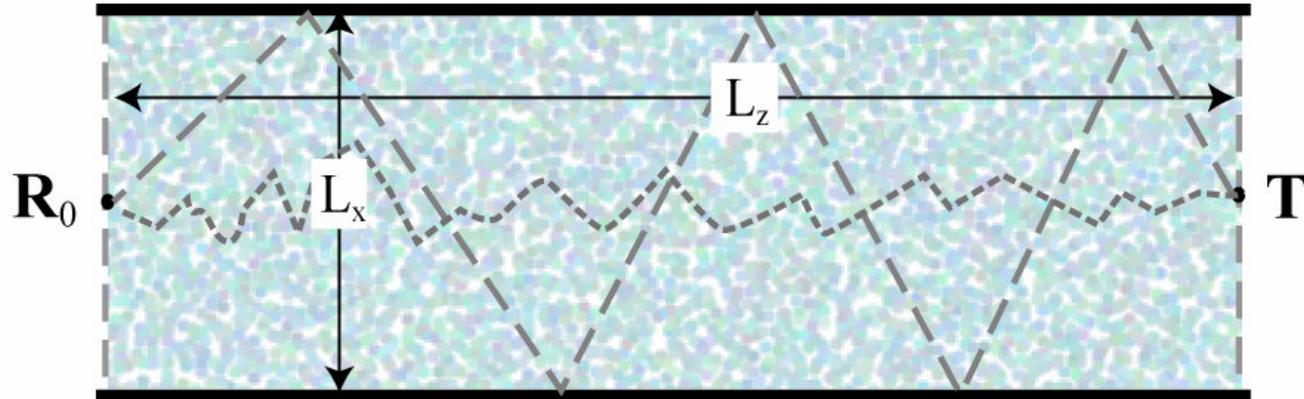
*Formal proofs of existence
and uniqueness (possibly) are
forthcoming!*

Workshop specific aims

- Explore the interface between computational wave propagation and wireless communications.
- *Research goal.* Develop realistic models of wave propagation in richly scattering environments that bridge the gap between parametric channel models and experiments.

Discussion question. *How do we best use these models for wireless?*

Random waveguide simulations



We use a waveguide to study wave propagation in a complex environment. It incorporates the following effects.

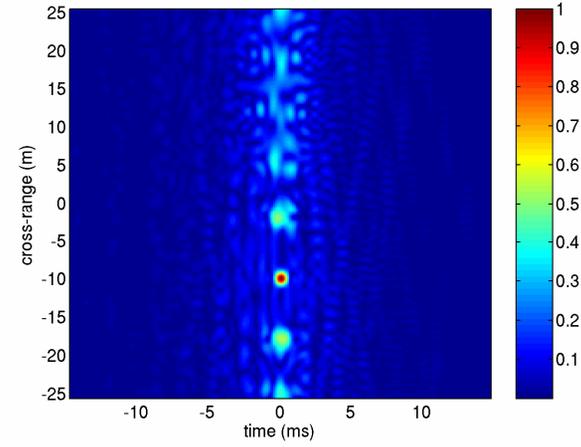
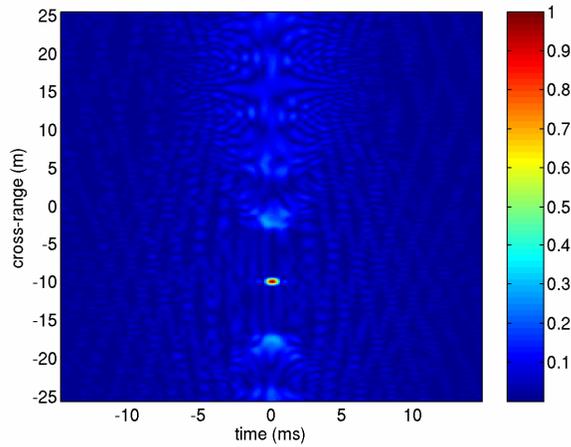
- *Angle diversity* control through hard reflections from waveguide walls and random scattering by inhomogeneities.
- *Delay spread* control through absorption.
- *Frequency diversity* control through system bandwidth.

Simulation results: space-time focusing

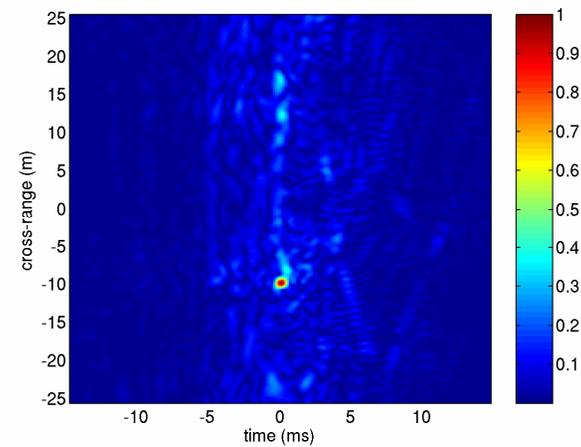
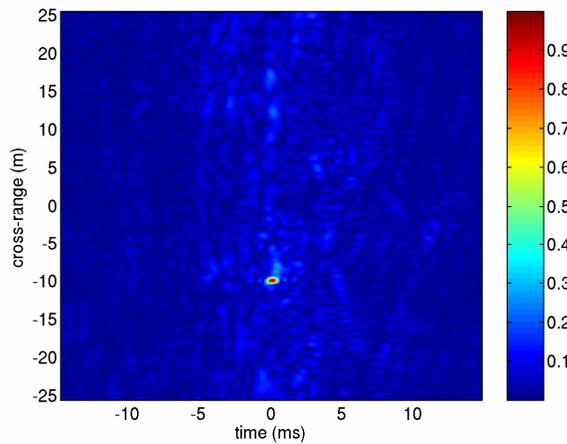
DSB ~ 100

DSB ~ 40

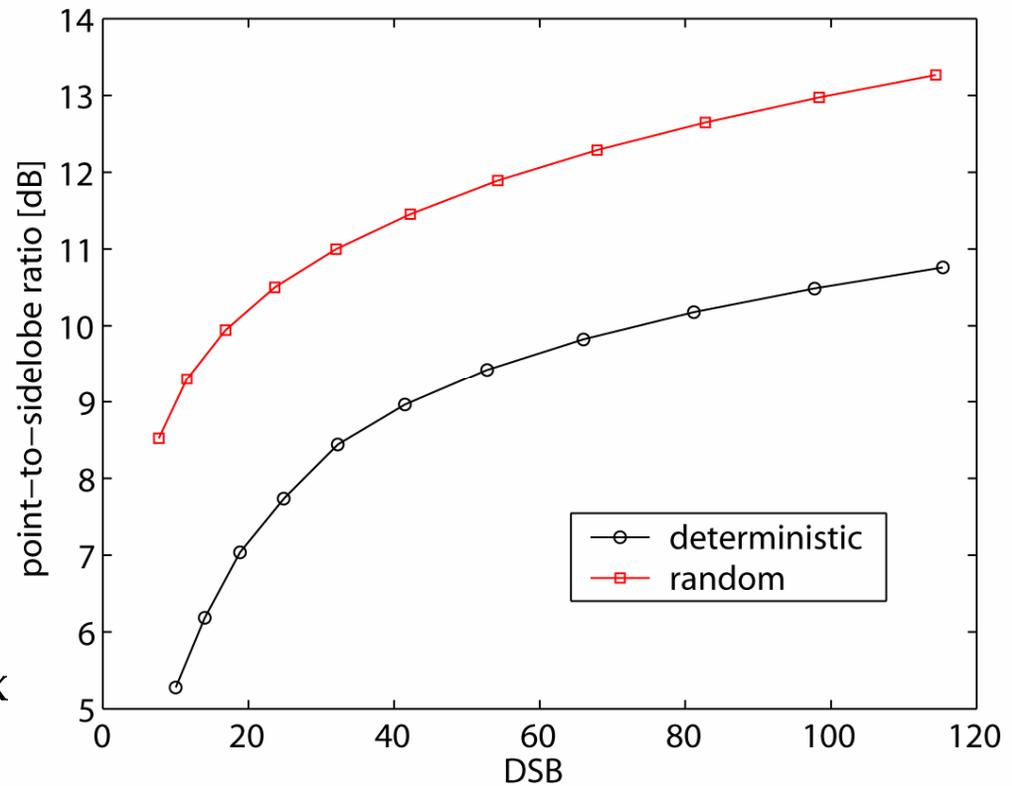
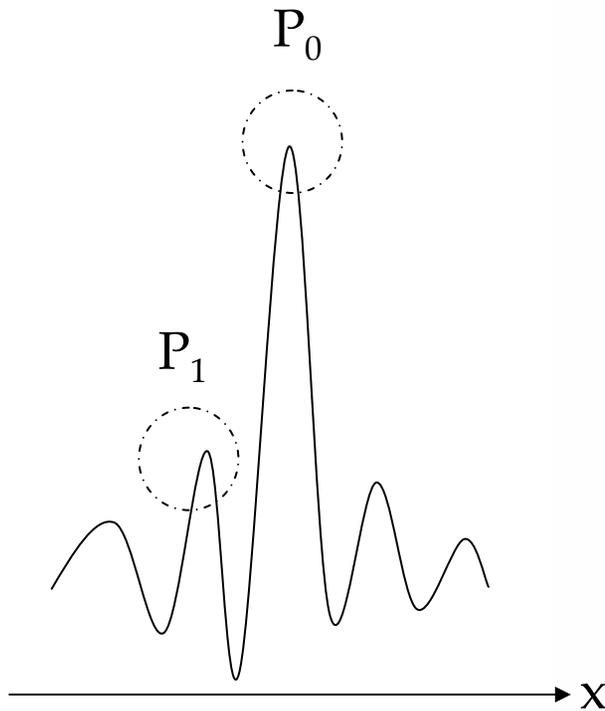
deterministic



random

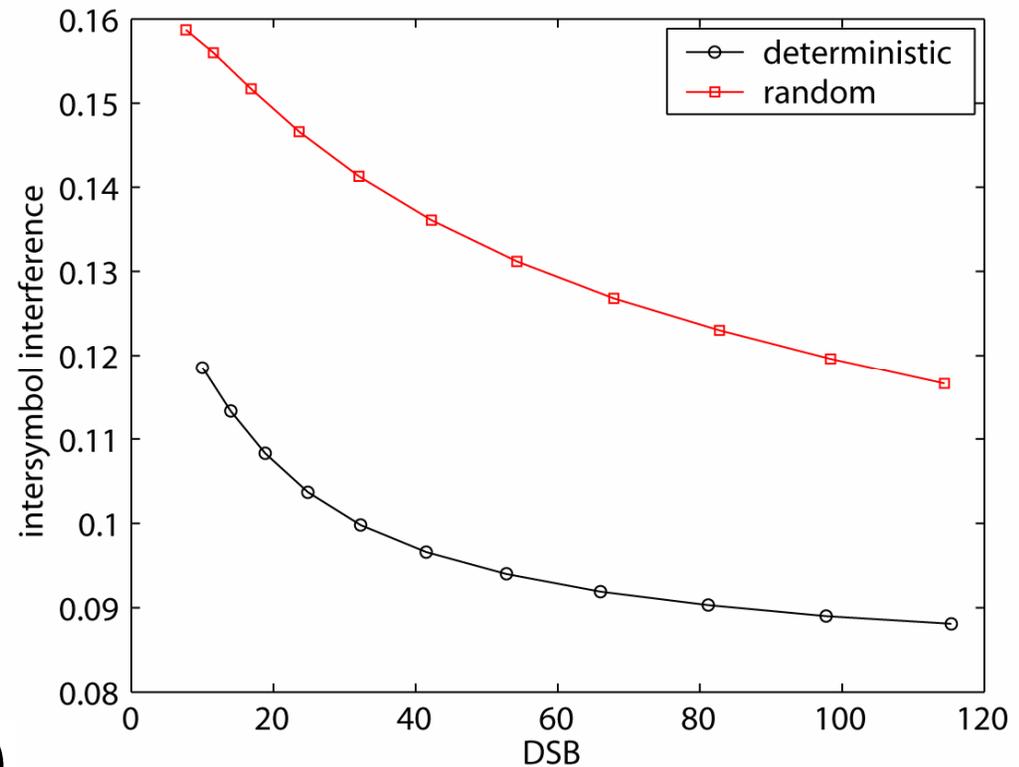
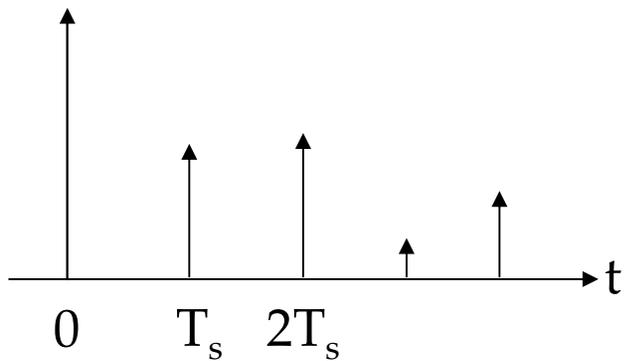


Space focusing: peak-to-sidelobe ratio



$$\text{peak-to-sidelobe} = \frac{P_0}{P_1}$$

Time focusing: intersymbol interference



$$\text{ISI} = \frac{\sum_{m \neq 0} P(mT_s)}{P(0)}$$

Discussion question

How do we use sophisticated wave propagation models in wireless communication problems?