Multipath Channel Dependence and Modeling in UWB Radio

Graduate Student: Robert Wilson
Faculty: Prof. Robert A. Scholtz

Research Goal

• Research in support of the design and deployment of ultrawideband wireless systems
• Determine the effect of channel properties on radio performance and determine key properties
• Reduce channel estimation and modeling complexity
• UWB channels can have hundreds of multipath components with intractable statistical descriptions

Role in IMSC

• UWB radio can provide high speed wireless communication for home networking, for example:
  • wireless audio
  • multimedia transmission
  • Fine resolution provides utility in ranging, sensing and imaging applications

Research Approach

• Compare published models and measured data for effect on system performance
• Look for trends as functions of measurable channel properties
• Recommend simplified models for system analysis
• Use simplified models to aid in radio design and analytical performance calculations

Accomplishments

• Alternative amplitude and time of arrival distributions shown not to have significant effect of performance of some common receivers
• Publications:

Uniqueness & Related Work

• Analyses of radio link performance assume some channel model a priori, often simplified for tractability, regardless of how accurately the model reflects real world behavior
• Channel modelers take the converse approach considering only congruity with empirical observations and neglecting model tractability
• The UltRaLab anechoic chamber and extensive instrumentation enable us to perform high-quality empirical work, our channel measurements are widely used and cited in UWB analysis and we maintain a large internet accessible database of measurements made by ourselves and others

5-Year Plan

• Comprehensive examination of the characteristics of common channel models
• Determine the performance of common receiver structures under each model. Infer how channel characteristics impact a system
• Apply models and channel understanding to aspects of receiver design such as:
  • multipath diversity
  • channel estimation