

Decreasing Artificial Attenuation of the RCSIM Radio Channel Simulation Software

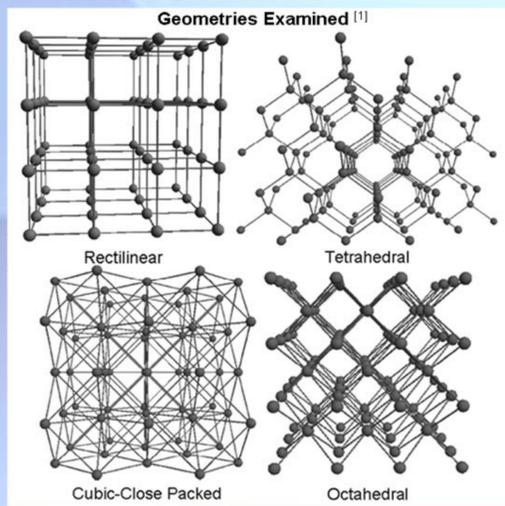
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Oak Ridge National Laboratory is currently improving the accuracy of the radio channel simulation software RCSIM by reformulating the scattering junctions that it uses to propagate a simulated radio wave. Radio waves naturally experience path loss (attenuation) as they move outward from the signal source. However, there is a certain level of artificial attenuation in computer simulations of radio wave propagation. The goal is to increase overall accuracy of the RCSIM software in part by decreasing this artificial attenuation.

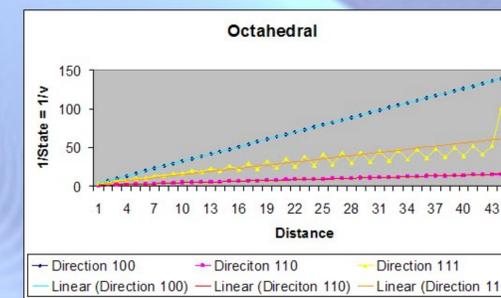
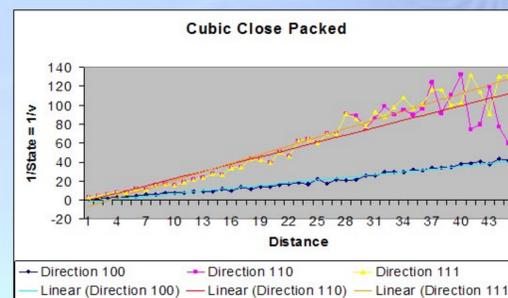
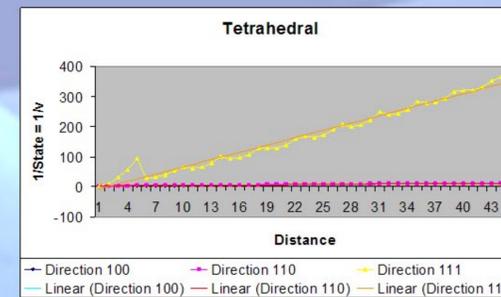
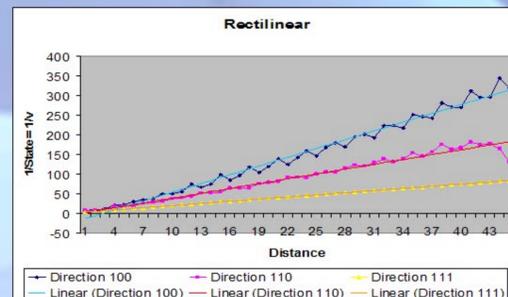
Background

- Radio waves naturally experience path loss (attenuation) as the wave moves outward from the source
- In computer simulations of radio waves, artificial attenuation occurs in relation to the geometry of signal scattering junctions, making simulators inaccurate



Methodology

- Build free-space simulators for each geometry using C++
- Choose points for each direction from the displacement (100, 110, 111)
- Compare maximum states for each data point to determine error values



Conclusions

- Error value for tetrahedral scheme is better than that of rectilinear scheme, it's directional dependencies are too great for practical use
- Error value for octahedral scheme is best. Although it experiences inaccuracies in the 111 direction as the edge of the space is approached
- Error value for cubic-close packed scheme is close enough to that of the octahedral to make it practical to implement as well and compare, though there is less consistency in the data from the cubic-close packed scheme.

Research Objective

- Find a geometry that will decrease artificial attenuation in the RCSIM software by more closely mirroring the natural sphere shape of actual path loss

Comparison of K Values				
	K Direction 100	K Direction 110	K Direction 111	K Average
Rectilinear	7.4162	4.0941	1.8167	4.44
Tetrahedral	0.2062	0.2043	8.1007	2.83
Cubic-Close Packed	0.9579	2.5612	3.0537	2.19
Octahedral	3.141	1.3634	0.3295	1.61

Future Research

- Implement octahedral scheme into RCSIM software to determine overall improvement to results
- Consider implementing the cubic-close packed scheme into the RCSIM software to determine improvement to overall results

[1] Campos, G.R. and Howard, D.M., "On the Computational Efficiency of Different Waveguide Mesh Topologies for Room Acoustic Simulation," *IEEE Trans. On Speech and Audio Processing*, vol. 13, pp.1063-1070, September 2005.