Nonlinear Equalization of RF Receivers

HPC-Enabled Search for a Near-Optimal Architecture

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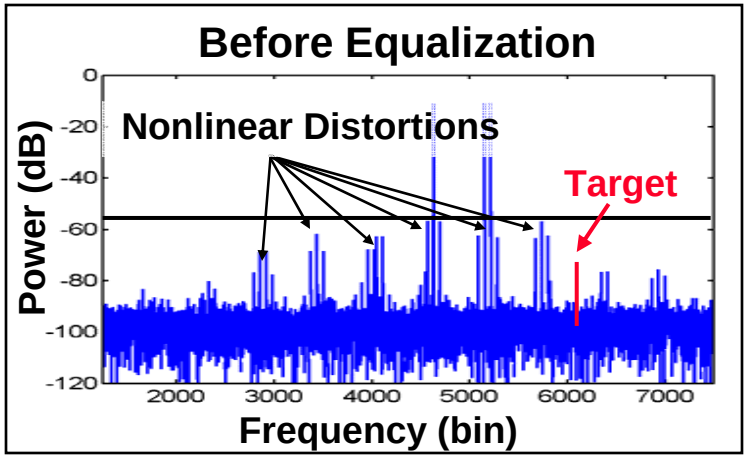
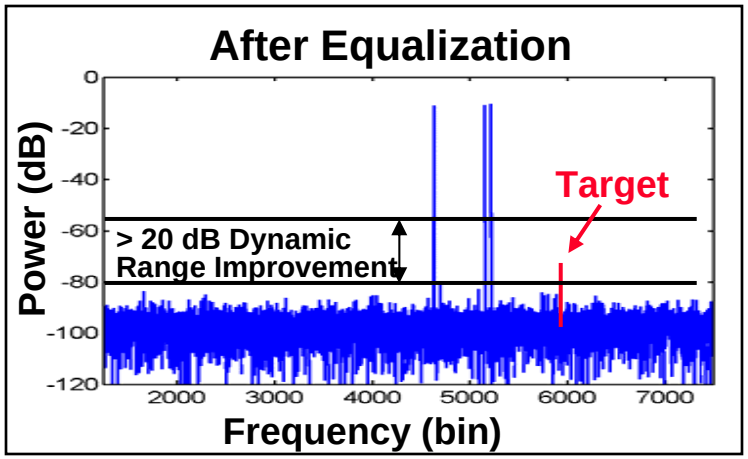
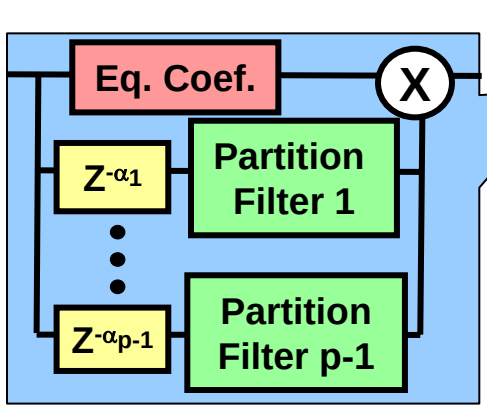
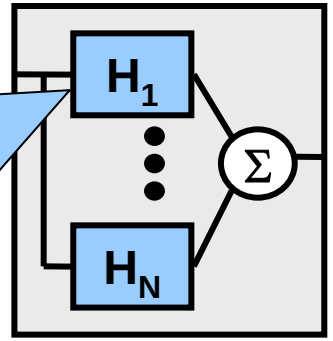
Nonlinear Equalization with the Partitioned Horizontal Coordinate System (PHoCS)





- Goal: increase dynamic range of receive chain by reducing nonlinear distortions





- Nonlinear filters typically have computational complexity too high for real-time operation
- PHoCS is a "pruned" version of the Volterra kernel with low real-time complexity, but . . .
- We need to search a large space for the best PHoCS architecture
- Algorithmic improvements and HPC enable this search

Computational Cost of Searching for a PHoCS Architecture

- Use a greedy search algorithm that iteratively finds the local optimum
- Comparisons required to choose N processing elements from a set of M:

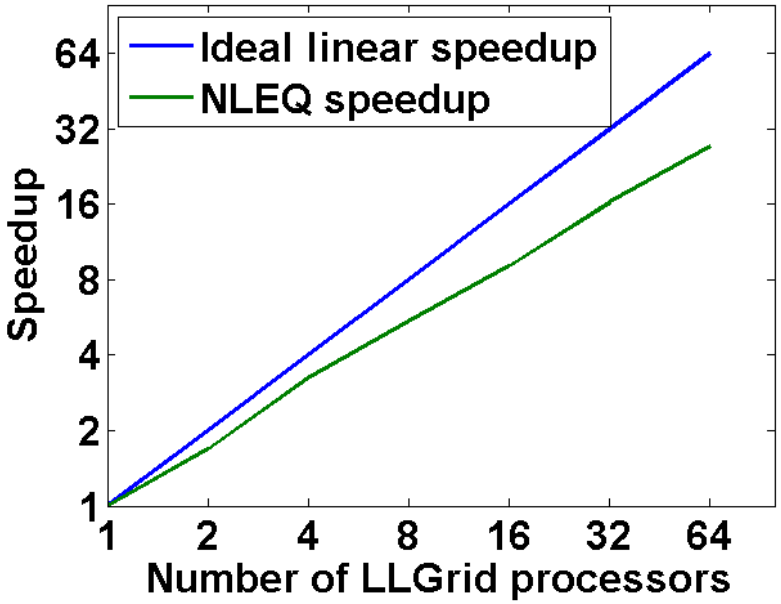
Typical Values	combinatorial search	greedy search
M = 1,200, N = 20	~10^{43}	24,000
M = 11,400, N = 80	~10^{205}	912,000

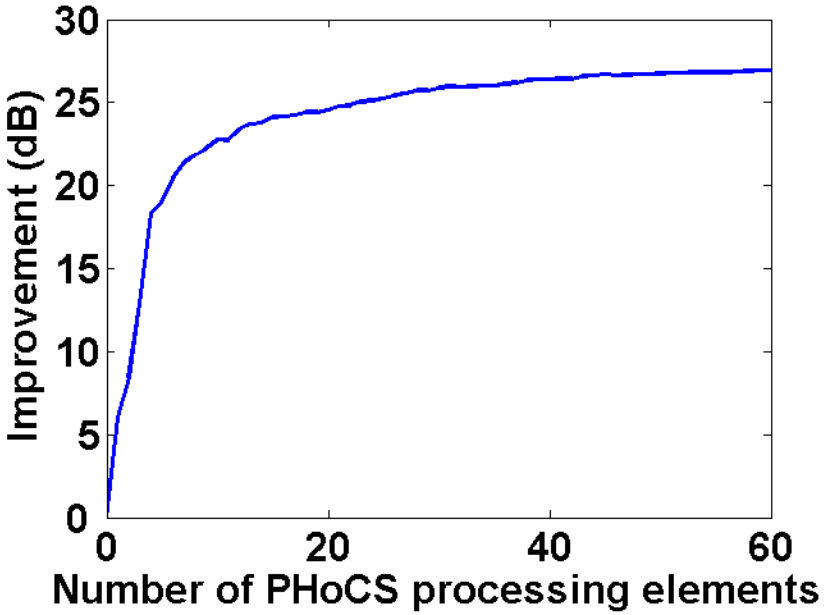
Intractable

Feasible

- Still, a typical experiment requires over 5x10^{14} operations

Results (Enabled by HPC Technologies)





MatlabMPI and LLGrid allow us to complete in days experiments that would have taken months

We can improve wideband ADC IFDR by 27 dB, decades beyond the state-of-the-art!