1023-94-1868 **Henry D Pfister*** (hpfister@tamu.edu), Texas A&M University, 3128 TAMU, College Station, TX 77843. *Rediscovering Our Roots: Coding Theory and Reed-Solomon Codes.*

Recent advances by Sudan and Guruswami have enabled efficient list decoding of Reed-Solomon (RS) codes up to $n-n\sqrt{R}$ errors. Although this offers little gain over $(n-nR)/2$ errors at high rates, various ways of interleaving m RS codes can help. For example, Krachkovsky's folded RS codes group symbols into m-tuples to get an $((q-1)/m, k/m)$ code over $\mathbb{F}_{q^m}$ and algebraic decoding corrects nearly $\frac{m}{m+1}(n-nR)$ errors with high probability.

In this talk, we first show that correcting t errors with an (n,k) RS code is identical to computing the amplitude and frequency of t sinusoids from $n-k$ equally spaced samples. Using this view, the original Peterson decoder becomes the classic method of Prony from 1795. But, to correct/estimate more than $(n-k)/2$ errors/sinusoids, we need to find a locator polynomial with more than $(n-k)/2$ roots. With a little insight from both fields, we find a shortened RS code and a decoder which can handle $2(n-k)/3$ errors/sinusoids with high probability. To avoid decoding failures, the decoder can be modified to output the list of possible codewords. So, we derive a lower bound on the average list size for this type of decoding and find that these constructions are nearly optimal for high rates. (Received September 27, 2006)