1011-14-205 **Farzad Parvaresh*** (fparvaresh@ucsd.edu), University of California, San Diego, 9500 Gilman Dr., La Jolla, CA 92093, and **Alexander Vardy** (vardy@kilimanjaro.ucsd.edu), University of California, San Diego, 9500 Gilman Dr., La Jolla, CA 92093. *Multivariate Interpolation Decoding of Reed-Solomon Codes And Decoding Beyond the Guruswami-Sudan Radius.*

We first present a new decoding algorithm for Reed-Solomon codes. The algorithm attempts to decode $M-1$ transmitted codewords together, using M-variate polynomial interpolation. It is shown that if the channel errors are synchronized — occur in the same positions in all the $M-1$ codewords — this algorithm can, in principle, correct up to $n(1-R^{(M-1)/M})$ errors in a Reed-Solomon code of length n and rate R, which is significantly higher than the Guruswami-Sudan decoding radius.

The second part of the presentation is about constructing family of algebraic codes that are provably decodable beyond the Guruswami-Sudan radius in the *worst-case*. The key idea is to combine multivariate interpolation decoding with a kind of "inverted" algebraic-geometric construction. That is, instead of evaluating certain functions at the rational points of a curve, we evaluate the rational points *themselves*, viewed as pairs of polynomials over a subfield, at certain elements of the subfield. (Received August 27, 2005)