1056-41-852 **Robert Calderbank*** (calderbk@math.princeton.edu), Department Of Mathematics, Princeton University, Princeton, NJ 08544, **Stephen D Howard** (Stephen.Howard@dsto.defence.gov.au), P.O. Box 1500, Edinburgh, 5111, Australia, and **Sina Jafarpour** (sina@cs.princeton.edu), Department of Computer Science, Princeton University, Princeton, NJ 08544. *Construction of a Large Class of Deterministic Sensing Matrices that Satisfy a Statistical Isometry Property.*

In the standard Compressed Sensing paradigm, the $N \times \mathcal{C}$ measurement matrix Φ is required to act as a near isometry on the set of all k-sparse signals (Restricted Isometry Property or RIP). If Φ satisfies the RIP, then Basis Pursuit or Matching Pursuit recovery algorithms can be used to recover any k-sparse vector α from the m measurements $\Phi\alpha$. Although it is known that certain probabilistic processes generate $N \times \mathcal{C}$ matrices that satisfy RIP with high probability, there is no practical algorithm for verifying whether a given sensing matrix Φ has this property. In contrast we provide simple criteria that guarantee that a deterministic sensing matrix acts as a near isometry on an overwhelming majority of k-sparse signals; in particular, most such signals have a unique representation in themeasurement domain. An essential element in our construction is that we require the columns of the sensing matrix to form a group under pointwise multiplication. The construction allows recovery methods for which the expected performance is sub-linear in $\mathcal{C}$, and only quadratic in N, as compared to the super-linear complexity in $\mathcal{C}$ of the Basis Pursuit or Matching Pursuit algorithms. (Received September 18, 2009)