

## Reduced rank technique for joint channel estimation and joint data detection in TD-SCDMA systems

### ABSTRACT

In time division-synchronous code division multiple access systems, the channel estimation for multiple subscribers requires the computation of very complicated algorithms through short training sequences. This situation causes mismodeling of the actual channels and introduces significant errors in the detected data of multiple users. This paper presents a novel channel estimation method with low complexity, which relies on reducing the rank order of the total channel matrix  $H$ . We exploit the rank deficient of  $H$  to reduce the number of parameters that characterizes this matrix. The adopted reduced rank technique is based on singular value decomposition algorithm. Equations for reduced rank-joint channel estimation (JCE) are derived and compared against traditional full rank-joint channel estimators: least square (LS) or Steiner, enhanced LS, and minimum mean square error algorithms. Simulation results of the normalized mean square error for the above mentioned estimators showed the superiority of reduced rank estimators. Multi-user joint data detectors based linear equalizers are used to suppress inter-symbol interference and mitigate intra-cell multiple access interference. The detectors: zero forcing block linear equalizer and minimum mean square error block linear equalizer algorithms are considered in this paper to recover the data. The results of bit error rate simulation have shown that reduced rank-JCE based detectors have an improvement by 5 dB lower than other traditional full rank-JCE based detectors.

**Keyword:** Joint channel estimation (JCE); Multi-user joint detection (MUJD); Reduced rank; Singular value decomposition (SVD); Time division-synchronous code division multiple access (TD-SCDMA systems)