LORNE APPLEBAUM, Princeton University

Multiuser Detection in Asynchronous On–Off Random Access Channels Using Lasso

We consider on–off random access channels where users transmit either a one or a zero to a base station. Such channels represent an abstraction of control channels used for scheduling requests in third-generation cellular systems and uplinks in wireless sensor networks deployed for target detection. A key characteristic of these systems is their asynchronous nature. We will introduce a Lasso-based scheme for multiuser detection in asynchronous on–off random access channels that does not require knowledge of the delays or the instantaneous received signal-to-noise ratios of the individual users at the base station. For any fixed maximum delay in the system, the proposed scheme allows an exponential number of total users with respect to code length—achieving almost the same problem dimension scaling relationships as that required in the ideal case of fully synchronous channels. Further, the computational complexity of the proposed scheme differs from that of a similar oracle-based scheme with perfect knowledge of the user delays by at most a log factor. The results presented here are non-asymptotic, in contrast to previous work for synchronous channels that only guarantees that the probability of error at the base station goes to zero asymptotically with the number of users. Finally, we give a deterministic code construction suitable for the delay agnostic system. The code construction is based on a cyclic code in which equivalence classes are assigned to users. The code's low coherence permits recovery guarantees with Lasso.