

Part II

Multiuser MIMO

In wireless communications, the spectral efficiency can be improved by exploiting the space domain when antenna arrays are employed. For example, space division multiple access (SDMA) [80–82] can be adopted with different beamforming techniques. If multiple antennas are equipped at both transmitter and receiver, we have MIMO channels formed by MIMO systems. Since a rich spatial diversity gain is obtained with MIMO channels, MIMO detection techniques have been well-discussed. Instead of performing an exhaustive search, tree search techniques (e.g., sphere decoding approaches [12, 83, 84]) are developed to provide the optimal performance in some cases with reduced complexity. Furthermore, using the properties of lattice, the LR-based low-complexity detectors [21–28, 85] are proposed which can provide a full receive diversity gain. In part I of the book, we have systematically introduced different low-complexity detection approaches for point to point MIMO systems.

In multiuser systems, due to users' different locations and channel conditions, it is possible to exploit another diversity gain, where the throughput can be maximized by choosing the user of the strongest channel gain at a time. The resulting diversity gain is called the multiuser diversity gain [40]. By extending multiuser systems to the case of MIMO systems [39], we have multiuser MIMO systems, where the multiuser MIMO user selection plays a key role in increasing the throughput or related SNR of channels. Although the achievable rate or related SNR can be used for the user selection criterion, it would be more practical to use a certain performance measure that is directly related to the performance of the actual detector or decoder employed. Therefore, in this part of the book, different user selection criteria are considered to maximize the performance of the actual MIMO detectors employed in multiuser MIMO systems.