

Low-density parity-check (LDPC) codes are capable of achieving excellent performance and provide a useful alternative for the high-performance applications. However, at medium to high signal-to-noise ratios, an observable error floor arises from the loss of independence of messages passed under iterative graph-based decoding. In this paper, the error floor performance of the short block length codes is improved by the use of a novel candidate selection metric in code graph construction. The proposed multipath extrinsic message degree (EMD) approach avoids harmful structures in the graph by evaluating certain properties of the cycles introduced in each edge placement. We present multipath EMD-based designs for several structured LDPC codes, including quasi-cyclic and the irregular repeat accumulate codes. In addition, an extended class of the diversity-achieving codes on the challenging block fading channel is proposed and considered with the multipath EMD design. This combined approach is demonstrated to provide the gains in decoder convergence and error rate performance. A simulation study evaluates the performance of the proposed and existing state-of-the-art methods.