An Approach to Evaluating the Number of Potential Cycles in an All-one Base Matrix

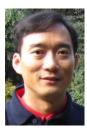Sheng Jiang and F.C.M. Lau

Department of Electronic and Information Engineering, Hong Kong Polytechnic University, Hong Kong

encmlau@polyu.edu.hk

Abstract— The ``Tree Method" is usually used to identify potential cycles in low-density parity-check codes. However, with the increasing demand of high girth codes, the method becomes hard to implement because of the exponential increase of both space complexity and time complexity. In this paper, a new method is introduced to evaluate potential cycles for all-one base matrix. The method applies to large cycle length and arbitrary size base matrix. The principle of potential cycle and potential cycle duplication are studied to support the new approach. Instead of doing low efficient exhaustive search, the approach gives the number of potential cycles without duplication directly. The results of cycle numbers are given, which are verified by the ``Tree Method".

Keyword— base matrix, LDPC codes, potential cycles

Francis C. M. Lau received the BEng (Hons) degree in electrical and electronic engineering and the PhD degree from King's College London, University of London, UK, in 1989 and 1993, respectively. He is a Professor and Associate Head at the Department of Electronic and Information Engineering, The Hong Kong Polytechnic University, Hong Kong. He is also a Fellow of IET and a Senior Member of IEEE.

He is the co-author of Chaos-Based Digital Communication Systems (Heidelberg: Springer-Verlag, 2003) and Digital Communications with Chaos: Multiple Access Techniques and Performance Evaluation (Oxford: Elsevier, 2007). He is also a co-holder of five US patents and one pending US patent. He has published over 280 papers. His main research interests include channel coding, cooperative networks, wireless sensor networks, chaos-based digital communications, applications of complex-network theories, and wireless communications. He was the Chair of Technical Committee on Nonlinear Circuits and Systems, IEEE Circuits and Systems Society. He served as an associate editor for IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II in 2004-2005 and IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS I in 2006-2007, abd IEEE CIRCUITS AND SYSTEMS MAGAZINE (2012-2015). He has been a guest associate editor of INTERNATIONAL JOURNAL AND BIFURCATION AND CHAOS since 2010 and an associate editor of IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II since 2016.