

Exact Split Information Function for SPC

Y. Min*, F. C. M. Lau*# and C. K. Tse*

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

#The Hong Kong Polytechnic University Shenzhen Research Institute

yue.min@connect.polyu.hk, encmlau@polyu.edu.hk, encktse@polyu.edu.hk

Abstract—Split information functions are used in deriving closed-form Extrinsic Information Transfer (EXIT) curves of super-variable nodes (SVNs) in doubly-generalized low-density parity-check (DGLDPC) codes. In this letter, we derive an exact split information function for single-parity-check (SPC) codes. The function is very easy to compute and has been verified against the results obtained using the traversal method.

Keyword—Doubly generalized LDPC codes, EXIT curve, split information function



Yue Min received the B.S. degree in Information Engineering from Anhui University of Science and Technology, Anhui, China in 2009. She received her M.Phil. degree at the Department of Electronic and Information Engineering in 2013 from Hong Kong Polytechnic University. She joined the Baidu (China) Co., Ltd. in 2013. Her research interest lies in the area of error-correction codes, particularly on the construction of generalized LDPC codes and the design of their fast decoders.



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 three US patents and one pending US patent. He has published over 250 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 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. He was also an associate editor of *DYNAMICS OF CONTINUOUS, DISCRETE AND IMPULSIVE SYSTEMS, SERIES B* from 2004 to 2007, a co-guest editor of *CIRCUITS, SYSTEMS AND SIGNAL PROCESSING* for the special issue *Applications of Chaos in Communications* in 2005, and an associate editor for *IEICE TRANSACTIONS (Special Section on Recent Progress in Nonlinear Theory and Its Applications)* in 2011. He has been a guest associate editor of *INTERNATIONAL JOURNAL AND BIFURCATION AND CHAOS* since 2010 and an associate editor of *IEEE CIRCUITS AND SYSTEMS MAGAZINE* since 2012. He is now serving as the Chair of Technical Committee on Nonlinear Circuits and Systems, IEEE Circuits and Systems Society.



Chi K. Tse received the BEng degree with first class honors and the PhD degree from the University of Melbourne, Australia, in 1987 and 1991, respectively. He is a Fellow of IEEE and also a Fellow of the Institution of Engineers Australia.

He is presently Chair Professor of Electronic Engineering at the Hong Kong Polytechnic University, and from 2005 to 2012 he was the Head of the Department of Electronic and Information Engineering. Since 2010, he has chaired the University's Culture Promotion Committee. His research interests include complex network applications, power electronics and nonlinear systems. He is the author of the books *Linear Circuit Analysis* (London: Addison-Wesley, 1998) and *Complex Behavior of Switching Power Converters* (Boca Raton: CRC Press, 2003), co-author of *Chaos-Based Digital Communication Systems* (Heidelberg: Springer-Verlag, 2003), *Digital Communications with Chaos* (London: Elsevier, 2006), *Reconstruction of Chaotic Signals with Applications to Chaos-Based Communications* (Singapore: World Scientific, 2007), *Sliding Mode Control of Switching Power Converters: Techniques and Implementation* (Boca Raton: CRC Press, 2012), and *Blind Source Separation and Signal Reconstruction in Sensor Networks* (Beijing: Publishing House of Electronics Industry, 2012) and co-holder of 5 US patents and 2 other pending US patents.

Prof. Tse received the L.R. East Prize from the Institution of Engineers, Australia, in 1987, the Best Paper Award from *IEEE TRANSACTIONS ON POWER ELECTRONICS* in 2001, Dynamics Days Europe Presentation Prize in 2002, and the Best Paper Award from *International Journal of Circuit Theory and Applications* in 2003. While with the Hong Kong Polytechnic University, he received the President's Award for Achievements in Research in 1997 and 2000, the Faculty Best Researcher Award in 2000, the Faculty Research Grant Achievement Award in 2004, and a few other teaching awards. He was selected an IEEE Distinguished Lecturer in 2005-06 and again in 2011-12. In 2007, he was awarded the Distinguished International Research Fellowship by the University of Calgary, Canada. In 2009, he and his co-inventors won the Gold Medal with Jury's Commendation from the International Exhibition of Inventions of Geneva, Switzerland, for a novel driving technique for LEDs, and in 2013 he was awarded another Gold Medal at the same exhibition. He has been appointed as Advisory/Guest Professor by a number of universities in China including

Beijing Jiaotong University, Wuhan University, Northeastern University, Beijing Institute of Technology, etc. In 2010, he has been appointed by the Ministry of Education, China, as Chang Jiang Scholars Chair Professor (2009) at Huazhong University of Science and Technology, China. In 2011, he was appointed Honorary Professor by RMIT University, Australia, and in 2012 Honorary Professor of Northeastern University of China. In 2013, he was awarded the Gladden Fellowship by the University of Western Australia.

Currently he serves as Editor-in-Chief for the IEEE Circuits and Systems Magazine and Editor-in-Chief of IEEE Circuits and Systems Society Newsletter. He was/is an Associate Editor for the IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS PART I — FUNDAMENTAL THEORY AND APPLICATIONS from 1999 to 2001 and again from 2007 to 2009. He has also been an Associate Editor for the IEEE TRANSACTIONS ON POWER ELECTRONICS since 1999. He also serves as Editor of the International Journal of Circuit Theory and Applications and is on the editorial boards of the International Journal and Bifurcation and Chaos and of the Journal of Systems Science. He also served as Guest Editor for the IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS PART I — FUNDAMENTAL THEORY AND APPLICATIONS in 2003, Guest Associate Editor for the IEICE Transactions on Fundamentals of Electronics, Communications and Computers in 2004--2006, and Guest Editor for Circuits, Systems and Signal Processing in 2005.

From 2006 to 2012, he was on the Engineering Panel of Hong Kong Research Grants Council, and since 2009 he has been on the Joint Research Scheme Panel of Hong Kong Research Grants Council. In 2013, he was appointed to the Steering Committee of Hong Kong Quality Education Fund.