Meeting: 1001, Evanston, Illinois, SS 5A, Special Session on Codes and Applications

1001-05-252 **Hossein Pishro-Nik*** (hossein@ece.gatech.edu) and **Faramarz Fekri** (fekri@ece.gatech.edu). *On Some Graph Theoretic Properties of LDPC Codes.*

We study some of the graph theoretic properties of LDPC code ensembles that affect their performance. We find the probability distributions of small cycles and stopping sets and discuss their effect on the error probability for binary-input output-symmetric channels. The complexity issues for stopping sets is also discussed. Let $g(n, \lambda, \rho)$ be the ensembles of multigraphs of LDPC codes of length n with degree distribution given by $\lambda(x)$ and $\rho(x)$. Let $Y_l(n, \lambda, \rho)$ be the number of stopping sets of size l in $g(n, \lambda, \rho)$. In particular consider the ensemble $g(n, \lambda, \rho)$ with $\rho(x) = x^{d_c - 1}$. Let $\mu_l = \frac{\left[\lambda'(0)\rho'(1)\right]^l}{2l}$ and let $Y_{l\infty} \in Po(\mu_l)$ be independent random variables with poisson distributions for $l = 1, 2, ...$ We show that the random variables $Y_l(n, \lambda, \rho)$ converge in distribution to $Y_{l\infty}$ jointly for all l. One simple corollary is the contiguity of $g(n, \lambda, \rho)$ and certain expurgated ensembles. We also prove that finding stopping sets in LDPC graphs is NP-hard. This shows that finding the probability distributions of stopping sets is very useful. (Received August 27, 2004)