Characterization of degree and energy distributions in asymptotically scale-free d-dimensional random networks

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It has already been reported in the literature [1,2] that a large class of preferential-attachment-based random d-dimensional growing networks exhibits q-exponential degree (k_i, defined as the number of sites that are already attached to site i) or energy (ε_i, defined as $\varepsilon_i = \Sigma_j^{k_i} w_{ij}/2$) distribution, where the link weights w_{ij} are random variables drawn from a quite generic distribution. The corresponding asymptotic power-law behavior is determined by the ratio α_A/d where α_A characterizes the distance-dependence in a preferential-attachment rule $\Pi_{ij} \propto \varepsilon_i/d_{ij}^{\alpha_A}$ $(\alpha_A \geq 0)$, where d_{ij} being the Euclidean distance between i and j. In order to cover more complex and realistic phenomena, we consider here a more general form, namely $\Pi_{ij} \propto \varepsilon_i / [d_{ij}^{\alpha_A} + c\, d_{ij}^{\gamma_A}$ $(\gamma_A > \alpha_A, c \geq 0)$. An interesting crossover is then observed and studied in the power-law behavior of the energy distribution [3].

References

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