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# Reliability Polynomials of Chorded Cycle Graphs

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Abstract:

We denote by $C_{c+x}^{c_1,c_2}$ the graphs comprised of a cycle on $c$ nodes having a single chord, with $c_1$ and $c_2$ cycle nodes on either side of the chord. When a graph is used to model a network, the All-Terminal Reliability (Rel) is the probability of network communication among all stations when the stations are perfectly reliable and the links fail with equal but independent probability. Thus, $Rel(G, p) = \sum_{i=0}^{|E(G)|} N_i\, p^i\, (1-p)^{|E(G)|-i}$, where $E(G)$ is the total number of edges, p is the probability of edge operation, and $N_i$ is the number of spanning connected subgraphs of size $i$. We present formulas for the Rel for all chorded cycle graphs having finite $c$, and prove that the uniformly most reliable such graph is the one in which $c_1 = c_2$ when $c$ is even, and in which $c_1$ and $c_2$ differ by one when $c$ is odd.