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*Orthogonal Colourings of Random Geometric Graphs*

An orthogonal colouring of a graph  $G = (V, E)$  is an injective assignment  $f : V \rightarrow [k]^2$  of a pair of colours to each vertex of  $G$ , so that each coordinate constitutes a proper colouring. So if  $f(u) = (a, b)$ ,  $f(v) = (a', b')$  and  $u$  and  $v$  are adjacent, then  $a \neq a'$  and  $b \neq b'$ . Since  $f$  is injective, every pair of colours occurs at most once on any vertex. We show results on the minimum number of colours needed for an orthogonal colouring of a regular type of grid graph, and use this to find orthogonal colourings of the random geometric graph  $GR(n, r)$ . In particular, we investigate for which choice of parameters we have that  $GR(n, r)$  almost surely has an orthogonal colouring that uses every colour pair exactly once.