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Orientable quadrilateral embeddings of cartesian products

White, Pisanski and others have proved a number of results on the existence of quadrilateral embeddings of cartesian products of graphs; in some cases these provide minimum genus embeddings. In a 1992 paper Pisanski posed three questions. First, if G and H are connected 1-factorable r-regular graphs with $r \geq 2$, does the cartesian product $G \times H$ have an orientable quadrilateral embedding? Second, if G is r-regular, does the cartesian product of G with sufficiently many even cycles have an orientable quadrilateral embedding? Third, if G is an arbitrary connected graph, does the cartesian product of G with a sufficient large cube $Q_n = \times^n K_2$ have an orientable quadrilateral embedding? We answer all three questions. The answers to the second and third questions are positive, as we show using a general theorem that answers both. We have also shown that the answer to the first question is negative, via some families of 3-regular examples.

This is joint work with Wenzhong Liu, Dong Ye and Xiaoya Zha.

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