Extension to even triangulations on surfaces

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An even triangulation is a 2-cell embedded graph where every face is a triangle and every vertex degree is even. It is also called an Eulerian triangulation. A quadrangulation is a 2-cell embedded graph where every face is a quadrangle. [1] shows that any quadrangulation on an orientable surface can be extended to an even triangulation by adding diagonal edges to all quadrangle faces. We improve this result to the nonorientable case. We also determine the number of distinct even triangulations. Furthermore, we consider the similar problems as follows: Can we extend to an even triangulation from a 2-cell embedded graph where every face is either triangle or quadrangle? What kinds of graphs can be extended to a 3-chromatic even triangulation? For these problems, we give necessary and sufficient conditions of the graphs.

References

[1] H. Zhang, X. He, On even triangulations of 2-connected embedded graphs, SIAM J. Comput. 34:3 (2005), 683–696.