Sizes of embedded coloring-critical graphs

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Abstract

A graph is k-critical if its chromatic number is k, but the chromatic number of every proper subgraph is at most $k-1$. Deep results of Thomassen show that 6-critical graphs embedded in a fixed surface, as well as 4-critical graphs of girth 5 embedded in a fixed surface, have size bounded by a function of genus. However, the function following from Thomassen's proofs is double-exponential in genus. We give new proofs (which we consider to be simpler) of these results, improving the bound to linear. We also consider the list-coloring generalization of the problem, as well as the case of triangle-free embedded graphs. (This talk is based on joint work with K. Kawarabayashi, D. Kral, L. Postle and R. Thomas).