

# Incompressibility of $H$ -free edge modification problems: Towards a dichotomy

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## Abstract

Given a graph  $G$  and an integer  $k$ , the  $H$ -FREE EDGE EDITING problem is to find whether there exists at most  $k$  pairs of vertices in  $G$  such that changing the adjacency of the pairs in  $G$  results in a graph without any induced copy of  $H$ . The problems  $H$ -FREE EDGE DELETION and  $H$ -FREE EDGE COMPLETION are defined similarly, where only deletion of edges are allowed in the former and only completion of edges are allowed in the latter. Building upon the dichotomy results characterizing the polynomial-time solvable and NP-hard cases of these problems (Aravind et al., SIAM J. Discrete Math., 2017), we obtain dichotomy results on the incompressibility of these problems for regular graphs  $H$ . We prove that for regular graphs  $H$ , these problems are incompressible if and only if  $H$  is neither complete nor empty, where the incompressibility assumes  $\text{NP} \not\subseteq \text{coNP/poly}$ . Further, for  $H$ -FREE EDGE EDITING we obtain a set  $\mathcal{H}$  of twenty one small graphs such that, if for every  $H \in \mathcal{H}$ ,  $H$ -FREE EDGE EDITING is incompressible, then  $H$ -FREE EDGE EDITING is incompressible for every graph  $H$  with at least five vertices but is neither complete nor empty.