an F- or A-rigid graph is critical, if it loses this property after deleting an arbitrary edge. We say that it is co-critical, if it loses this property after adding an arbitrary edge.

Problem: *Except the digraph* $(\{0, 1\}, \{(0, 1)\})$ *which is critical and co-critical F-rigid, do there exist any further graphs and digraphs which are simultaneously critical and co-critical F- or A-rigid?*

We shall give an example of an infinite graph which is simultaneously critical an co-critical A-rigid.

Theorem 2. *There exists an infinite graph which is simultaneously critical and co-critical A-rigid.*

Proof. Let G be the graph with the property that all connected components of G are finite A-rigid graphs and for each finite connected A-rigid graph there exists exactly one connected component of G isomorphic to it. The connected components of G are pairwise non-isomorphic and each of them is A-rigid, hence G is a A-rigid. Let e be an edge of G, let C be the connected component of G containing e. Let $G - e$ (or $C - e$) be the graph obtained from G (or C, respectively) by deleting e. The graph $C - e$ has one or two connected components; they are also connected components of $G - e$. If a connected component of $C - e$ is not A-rigid, then we may take a non-identical automorphism of this component and extend it to a non-identical automorphism of $G - e$ by adding identical automorphisms of the other connected components. If a connected component of $C - e$ is A-rigid, then it is isomorphic to an other connected component C_0 of G and also of $G - e$. We take an automorphism of $G - e$ which maps these isomorphic components onto each other and whose restriction onto each connected component different from them is the identical automorphism of this components. This automorphism is a non-identical automorphism of $G - e$, hence $G - e$ is not A-rigid. We have proved that G is critical A-rigid. Quite analogously we can prove that G is co-critical A-rigid.

Obviously, the problem of the existence of a critical and co-critical A-rigid finite graph remains open.

Reference

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Author's address: 460 01 Liberec 1, Komenského 2 (katedra matematiky VŠST).