

Reconfiguration of homomorphisms to reflexive digraph cycles

Richard Brewster* Thompson Rivers University; Jae Beck Lee, Mark Siggers Kyungpook National University

Let G and H be graphs. A graph homomorphism $\phi : G \rightarrow H$ is a generalization of a vertex colouring of G , and a *reconfiguration* of ϕ to a homomorphism $\psi : G \rightarrow H$ is a generalization of recolouring. We examine the situation where H is a reflexive digraph cycle and show if H does not contain a 4-cycle of algebraic length 0, the reconfiguration problem can be solve in polynomial time. In the case of a no instance there is a certifying obstruction (based on a topological notion of winding around a cycle). A reconfiguration sequence from ϕ to ψ corresponds to a walk in the so-called *Hom-graph* $\text{Hom}(G, H)$. In the case of graphs such walks correspond to recolouring one vertex at a time, while the situation for digraphs is more complicated.

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