1171-05-45    **Anton Dochtermann\*** (`dochtermann@txstate.edu`) and **Anurag Singh** (`asinghiitg@gmail.com`). *Homomorphism complexes, reconfiguration, and homotopy for directed graphs.*

The neighborhood complex of a graph was introduced by Lovasz to provide topological lower bounds on chromatic number, and more general homomorphism complexes of graphs were further studied by Babson and Kozlov. Such 'Hom complexes' are also related to reconfiguration problems and a notion of discrete homotopy for graphs. Here we initiate the detailed study of Hom complexes for directed graphs, which have applications in the study of graded posets and resolutions of monomial ideals. We introduce a notion of a neighborhood complex for a directed graph, prove that its homotopy type is recovered as a certain Hom complex, and establish a number of results regarding its topology. Inspired by notions of reconfigurations of directed graph colorings we study the connectivity of $\mathrm{Hom}(G, T_n)$ for tournaments $T_n$. We obtain a complete answer for the case of transitive $T_n$, where we also describe a connection to mixed subdivisions of dilated simplices. Finally we use Hom complexes to define various notions of (directed) homotopy for directed graphs, some of which relate to constructions from the literature. This is joint work with Anurag Singh. (Received August 06, 2021)