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*Groups which are not Automorphism Groups of Graphs*

Frucht's theorem states every group is the automrophism group of a graph. This was shown in ZFC in 1960. We show Frucht's theorem also holds in ZF, by a similar proof, but that the proof critically relies on foundation.

In ZFA set theory (ZF with atoms), we will show Frucht's theorem can fail, and there are counterexamples in many common permutation models. Frucht's theorem can also hold in ZFA for non-trivial reasons, as happens in the ordered Mostowski model. We will examine Frucht's theorem over ZFA, and talk about what this might mean for models of ZF.