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Coarse Geometry of the Firefighter Problem

A fire breaks out on a finite set of vertices of a graph G. Then a firefighter protects n vertices not on fire. At each subsequent integral time, the fire spreads to all adjacent unprotected vertices and then the firefighter protects n unburned vertices. The graph G has the n-containment property if for every finite initial fire, there is an strategy to contain the fire protecting n vertices at each turn. A graph G has the fire containment property if there is an integer n such that it has the n-containment property.

Quasi-isometry is an equivalence relation on metric spaces which favors the large scale geometry and ignores the small scale details. Our main result is that for the class of graphs with a bound on their degree, having the fire containment property is preserved by quasi-isometry. Some sample consequences of our result are that any regular tiling of the Euclidean plane has the fire containment property, no regular tiling of the n-dimensional Euclidean space has the containment property if $n > 2$, no regular tiling of the n-dimensional hyperbolic space has the containment property if $n \geq 2$.

This is joint work with Danny Dyer and Brandon Thorne from Memorial University.