We consider the problem of decontaminating nanoscale regions using robots. These regions are modeled as finite induced subgraphs of the triangular lattice and are assumed to be contaminated by an arbitrarily fast spreading contaminant. Finite-state automaton robots are tasked with decontaminating the environment by moving a set of hexagonal tiles across it, which are able to block the contaminant. We develop algorithms for decontaminating several classes of environments and consider the number of tiles needed in comparison to the optimum as well as their runtime. For parallelograms, we are able to achieve that optimum. We achieve approximation factors of $O(1)$ for convex environments, $O(\log n)$ for n-node environments without holes, and $O(\sqrt{n})$ for environments with holes fitting inside a hexagon of radius $O(\sqrt{n})$. We further prove that the problem of determining the minimum number of tiles sufficient for decontamination is NP-complete. We show that the runtime of these algorithms can be improved linearly in the number of robots.

A related problem is the decontamination of polygonal environments by sweeping them with barrier curves. The contaminant is assumed to spread instantly along all paths not blocked by a barrier. The sweepwidth of a polygon is defined as the minimum over the maximum total length of barriers during a decontamination sweep. Computing sweepwidth for a given polygon is known to be NP-hard. We develop approximation algorithms for computing sweepwidth of an n-vertex polygon, achieving an approximation factor of $O(1)$ for convex polygons in $O(n)$ time, $O(\log n)$ in $O(n)$ for simple polygons, $O(\log n)$ in $O(n^{13}\log^4n)$ and $O(\sqrt n)$ in $O(n\log^4 n)$ for complex polygons. Further, we define a class of polygons consisting of aligned squares attached to each other in a tree-like fashion, for which we achieve $O(1)$ approximation in $O(n^3\log n)$ time. These algorithms construct decontamination sweeps explicitly.