Summary: We study $k$-spine, $h$-bend planar drawings in which each vertex of a planar graph $G$ lies on one of $k \geq 1$ horizontal lines and each edge of $G$ is drawn as a polyline containing at most $h \geq 0$ bends. A graph with a $k$-spine, $h$-bend planar drawing is said to be $k$-spine, $h$-bend planar. We mainly focus on $k$-spine, 1-bend planar drawings, showing that for each $k \geq 2$, there exists a planar graph that is not $k$-spine, 1-bend planar, and furthermore, that it is $\mathcal{NP}$-hard to test $k$-spine, 1-bend planarity. Given this complexity result, we further narrow our focus onto 2-spine, 1-bend planar drawings. We characterize 2-spine, 1-bend planarity using a new generalization of Hamiltonian graphs that we call Hamiltonian-with-handles graphs. We observe that our characterization naturally extends the connection between 2-page book embeddings and Hamiltonicity. Finally, we use our characterization to show that 2-outerplanar graphs are 2-spine, 1-bend planar.

MSC: 68R10 Graph theory (including graph drawing) in computer science

Keywords:
graph drawing; graph theory; spine drawing; planarity; Hamiltonicity

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