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Weakly infinite-dimensional compacta and C-compacta via polyhedra and simplicial complexes

Below, all spaces are compact.

Definition 1. Let K be a polyhedron. A mapping $f\colon X \to \mathrm{Cone}(K)$ is said to be *K-essential* if the mapping $f|_{f^{-1}(K)}\colon f^{-1}(K) \to K$ extends over X.

For a class $\mathcal{K}$ of polyhedra, a space X is called *$\mathcal{K}$-weakly infinite-dimensional* (notation: $X \in \mathcal{K}\text{-}wid$) if for any sequence $f_i\colon X \to \mathrm{Cone}(K_i)$, $i \in \mathbb{N}$, $K_i \in \mathcal{K}$, there exists n such that the mapping

$$f_1\Delta\ldots\Delta f_n\colon X \to \prod_{i=1}^{n} \mathrm{Cone}(K_i) = \mathrm{Cone}(*_{i=1}^{n}K_i)$$

is $\left(*_{i=1}^{n}K_i\right)$-inessential. If $\mathcal{K}$ consists of one polyhedron K we write $\mathcal{K}\text{-}wid = K\text{-}wid$.

Definition 2. Let $\mathcal{G}$ be a class of finite simplicial complexes. A space X is said to be *$\mathcal{G}$-C-space* (notation: $X \in \mathcal{G}\text{-}C$) if for each sequence $u_i = \{U_1^i, \ldots, U_{k_i}^i\}$, $i \in \mathbb{N}$, of covers of X there exist families $v_i = \{V_1^i, \ldots, V_{k_i}^i\}$ of open subsets of X such that

1. $V_j^i \subset U_j^i$;
2. $N(v_i) \subset G_i \in \mathcal{G}$, where $N(v)$ denotes the nerve of the family v;
3. $\cup_{i=1}^{n} v_i$ is a cover of X for some n.

We investigate classes $\mathcal{K}\text{-}wid$ and $\mathcal{G}\text{-}C$ and their relationships with the classes wid of weakly infinite-dimensional compact spaces and C of compact C-spaces. In particular, we show that

$$wid \subset \mathcal{K}\text{-}wid$$

for an arbitrary $\mathcal{K}$ and

$$C = \mathcal{G}\text{-}C$$

for an infinite $\mathcal{G}$ with $\dim(\mathcal{G}) < \infty$.

Question. Is it true that $wid = K\text{-}wid$ for a simply connected K with torsion-free homology groups $H_*(K)$?