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Singular chain complex over $\mathbb{Z}$ functor on topological spaces

Definition. Singular chain complex functor on category of topological spaces

We define the **singular chain complex functor** on category of topological spaces

$$\text{sing}_* : \text{Top} \rightarrow \text{Ch}_*(\text{Ab})$$

which

- maps topological spaces to the [singular chain complex](#)

$$X \mapsto \text{sing}_*(X)$$

- maps continuous maps

$$f : X \rightarrow Y$$

to the morphism of chain complexes

$$\begin{aligned} f_* : \text{sing}_*(X) &\rightarrow \text{sing}_*(Y) \\ \sum n_i \sigma_i &\mapsto \sum (f \circ \sigma_i) \end{aligned}$$



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is a functor.

Composition of the singular chain complex functor with the homology

$$\text{Top} \xrightarrow{\text{sing}_*} \text{Ch}_*(\text{Ab}) \xrightarrow{H_n} \text{Ab}$$

gives a functor

$$H_n : \text{Top} \rightarrow \text{Ab}$$

called the **n -th singular homology functor**.

- path connected components [sett.Top.complex sing. \$\mathbb{Z}\$.path comp](#)
- [Homotopy invariance of singular homology functor on topological spaces](#)

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