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Coherent Homomorphisms of H-spaces

0. Let X and Y be H-spaces, associative up to coherent homotopies. We define a space $\mathrm{HOM}_{\mathrm{ass}}(X,Y)$ of "homomorphisms up to a coherent homotopy" $X \to Y$, and constructs a spectral sequence

$$_{(0)}E_2^{st} \Longrightarrow \pi_{-s-t}(\mathrm{HOM}_{\mathrm{ass}}(X,Y))\,.$$

A natural mapping $_{(0)}\varphi\colon \mathrm{HOM}_{\mathrm{ass}}(X,Y) \longrightarrow \mathrm{Map}_*(BX,BY)$ is constructed where BX and BY are the deloopings of X and Y respectively. For a number of cases the morphism $_{(0)}\varphi$ is investigated and appears to be a homotopy equivalence.

1. Let now X and Y be "homotopy everything" H-spaces, such that the multiplication in both spaces is associative and commutative up to coherent homotopies. We define a space $\mathrm{HOM}_{\mathrm{asscomm}}(X,Y)$ similar to the space $\mathrm{HOM}_{\mathrm{ass}}(X,Y)$ above. The coherent homotopies involved should "interact" with the coherent homotopies of associativity and commutativity. One constructs also a spectral sequence

$$_{(1)}E_2^{st} \Longrightarrow \pi_{-s-t}(\mathrm{HOM}_{\mathrm{asscomm}}(X,Y))\,.$$

A natural mapping

$$_{(1)}\varphi\colon \mathrm{HOM}_{\mathrm{asscomm}}(X,Y) \longrightarrow \mathrm{Map}_{\,\mathrm{Spectra}}(Sp(X),Sp(Y))$$

is considered where $Sp(X)$ and $Sp(Y)$ are the corresponding Ω-spectra that infinitely deloops X and Y. For a number of cases $_{(1)}\varphi$ appears to be a homotopy equivalence.

2. Finally, let X and Y be $\mathcal{C}$-spaces where $\mathcal{C}$ is an operad in the sense of J. P. May. We construct a space $\mathrm{HOM}_{\mathcal{C}}(X,Y)$ and a spectral sequence $_{(2)}E_2^{st} \Longrightarrow \pi_{-s-t}(\mathrm{HOM}_{\mathcal{C}}(X,Y))$. For some cases, the terms $_{(2)}E_2^{st}$ are calculated.

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