① signs for your paper. Discuss pairing of bar cochains to give Hochschild cochains.

$\psi(f,g)$ but if properly understood maybe it includes ~~sss~~ S, K in some form. Keep this goal in mind

So let us begin with the sort of formulas to be derived.

Calculus [redacted] basic cochains are $g(a) = a^-$
$\rho(a) = a^+$

Rules

$$b'\rho = \rho^2 + g^2$$

$$b' g = \rho g + g\rho \qquad \therefore \left(b' - \mathrm{ad}(\rho)\right)(g) = 0.$$

from which it follows that

$$b'(g^n) = \rho g^n - (-1)^n g^n \rho$$

Must deal with cochains of form

$$\tau^\natural(\partial\rho\, g^n)(a_0, \ldots, a_n) = \tau(a_0^+ a_1^- \cdots a_n^-)$$

$$b\tau^\natural(\partial\rho\, g^n) = \tau^\natural\left(\partial(b'\rho)\, g^n - \partial\rho\, b'(g^n)\right)$$

$$= \tau^\natural\left(\partial(\rho^2+g^2)\, g^n - \partial\rho\left(\rho g^n - (-1)^n g^n\rho\right)\right)$$

$$= \tau^\natural\Big((\cancel{\partial\rho\,\rho} + \rho\partial\rho) g^n + (\partial g\, g + \underbrace{g\partial g) g^n}_{\substack{\text{sign } (-1)^{n+1} \\ \text{from cochain degree} \\ \text{\& same sign} \\ \text{from values.}}}$$
$$- \cancel{\partial\rho\,\rho}\, g^n + (-1)^n \partial\rho\, g^n \rho\Big)$$

$$= 2\tau^\natural(\partial g\, g^{n+1}) = 2\tau(g^{n+2})$$

$$B\tau^\natural(\partial\rho\, g^{n+2}) = \sum_{i=0}^{n+1} \lambda^i \tau(g^{n+2}) = (n+2)\tau(g^{n+2})$$

(2) Goal: To work out your cochain calculus in the reduced picture.

Main identity will be

$$b\tau^\natural(\partial f\, g) = \tau^\natural\big(\partial(b'f)g + (-1)^{|f|}\partial f\; b'g\big)$$

Is $\tau^\natural(\partial f\, g) = \sum_{i=0}^{p} \lambda^i \tau(fg)$ $p = |f|$. obviously should works.

~~Cochains — bar resolution~~

Suppose we consider things again.

~~Get~~

~~main ident~~

when you do the reduced theory you have ~~the~~ to use $\delta + ad(\rho)$ on <u>reduced bar cochains</u>

$$0 \longrightarrow (\bar{A}^{\otimes n+1})^* \longrightarrow (A \otimes \bar{A}^{\otimes n})^* \xrightarrow{s} (\bar{A}^{\otimes n})^* \longrightarrow 0$$

All this will be unclear especially if you write

$$\boxed{\tau^\natural(\partial q\, q^n) = \tau(q^{n+1})}$$

Homotopy formula $d: Q \longrightarrow \Omega^1 Q$ even case

$$Td(\rho q^n) = T(d\rho\, q^n) + T\Big(\rho \sum_1^n q^{i-1}\, dq\, q^{n-i}\Big)$$

$$= \lambda^{-1} T(q^n d\rho) + \sum_1^n (-1)^{n-i} \lambda^{n-i}\, T(q^{n-i} \rho q^{i-1}\, dq)$$

③ Cochain calculus for normalized Hoch. cochains. What are the problem?

We want mechanisms to produce normal. Hochschild cochains, preferably [redacted] involving the Karoubi operation $\mathbf{K}$.

$$\tau^{4}(\partial f\, g) = \sum_{i=0}^{p-1} \lambda^{i}\, \tau(fg) \quad \text{if } |f| = p$$

∂f

$$\begin{tikzcd} 0 \arrow[r] & B \arrow[r, "\Delta"] & B\otimes B \arrow[r] \arrow[dr] & \Omega^{B} \arrow[r] \arrow[d] & 0 \\ & & & B & \end{tikzcd}$$

Let's see if we can put together a $f \in (A \otimes \bar{A}^{\otimes p})^{*}$ and $g \in (\bar{A}^{\otimes q})^{*}$ together using Karoubi's operator instead of λ.

Another viewpoint: Instead of ~~nonsingular~~ basic forms on $\mathcal{G}$ take invariant ones:

[redacted]

$$\mathrm{Hom}(\underbrace{\Lambda \bar{\mathfrak{g}}}_{A\otimes M_N},\ \mathcal{L}(H)\otimes M_N)^{G}$$

$$(A \otimes \bar{A})^{\otimes n}$$

$$\Omega^{1} \otimes_{A} \cdots \otimes_{A} \Omega^{1}$$

Idea: Suppose we have $f : \Omega^{p}A \longrightarrow R$ and $g : \bar{A}^{\otimes q} \longrightarrow R$ then we can put them together

(4) Review supercam. ungraded case.

$$f = \mathrm{LT}\left(\tau^\natural\left(\partial\theta\, e^{u(X^2+[\sigma X,\theta])}\right)\right)$$

$$= \tau^\natural\left(\partial\theta \frac{1}{\lambda - X^2 - [\sigma X,\theta]}\right)$$

$$f_{2n+1} = \tau^\natural\left(\partial\theta \frac{1}{\lambda - X^2}\left([\sigma X,\theta]\frac{1}{\lambda - X^2}\right)^{2n+1}\right)$$

$$\left[\delta + \theta + \sigma X, \frac{1}{\lambda - X^2 - [\sigma X,\theta]}\right] = 0.$$

$$\frac{1}{\lambda - X^2 - [\sigma X,\theta]} = \sum_{k\geq 0} \underbrace{\frac{1}{\lambda - X^2}\left([\sigma X,\theta]\frac{1}{\lambda - X^2}\right)^k}_{R_k}$$

$$[\delta + \theta, R_k] + [\sigma X, R_{k+1}] = 0$$

because $$\frac{1}{\lambda - X^2}[\sigma X,[\sigma X,\theta]]\frac{1}{\lambda - X^2} = \frac{1}{\lambda - X^2}[X^2,\theta]\frac{1}{\lambda - X^2}$$

$$= -\left[\delta + \theta, \frac{1}{\lambda - X^2}\right]$$

$$\therefore\quad \delta\,\tau^\natural(\partial\theta R_k) = \tau^\natural([\delta+\theta, \partial\theta R_k])$$

$$= \tau^\natural(-\partial\theta[\sigma X, R_{k+1}])$$

$$= \tau^\natural(\partial[\sigma \cancel{X},\theta]\; R_{k+1})$$