Abstract
Let $\Lambda$ be a vector space of dimension $n$. The set of algebra structures on $\Lambda$ is denoted by $\mathcal{A}(\Lambda)$. This is nothing but the vector space $\Lambda \otimes \Lambda$.

All vector spaces have the same ground field $F$, which is either the field $\mathbb{R}$ of real numbers or the field $\mathbb{C}$ of complex numbers.

(a) Notations and definitions

Algebra structures and anomalies
Of course any algebra $A$ is either symmetric or skew symmetric.

**Definition 0.1** An algebra $A$ is called skew symmetric if it is not skew symmetric.

$\forall \eta \in A \exists \gamma \in A : \eta \Lambda = \gamma$, $\Lambda \in \Lambda \times \Lambda$.

**Definition 0.2** An algebra $A$ is called symmetric if $\forall \eta \in A : \eta \Lambda = \eta$.

Thus an algebra of dimension $n$ is a pair $A$ where $(\eta, \Lambda) = A$. 
\[ \forall \Lambda \ni m, n \ni \forall \omega, \theta = (m, \omega, n) \]

Thus, \((\eta', \Lambda) = \forall \)

\[ (\eta', \Lambda) = \forall \]

Definition 0.3. The function \(\eta' \) is called Jacobi anomaly of

\[ ((m, \omega, n) \eta' f = (m, \omega, n) \eta' f \]

Let \(\Lambda \times \Lambda \times \Lambda\) be a skew symmetric algebra. Denote by the \(\eta' f\) skew symmetric algebras \(\Lambda \) - Jacobi anomaly:

(i) Skew symmetric algebras \(\Lambda\) - (q) Anomalies.
associate of \( A \)

\[ (m, (n, n)) \rightarrow (m, n, n) \rightarrow (m, n) \]

ass \( \) is called \( \) defined by \( m, n \) \( \Lambda \) be an asymmetric algebra. \( \Lambda \) valued \( \) linear

Let \( ^{u}A \cdot \Lambda = A \cdot ^{u} \Lambda \)

\( \) asymmetric algebras \( \) asymmetric and K-anomaly

\( (\|) \) asymmetric algebras

\( \) few things are known about it topology

varieties. Few things are known about it topology

a sub-variety of \( A \) \( \) is a singular algebrial

\( (u) \) \( \) is a singualr algebraic

Thus \( \) \( \) \( (u) \) \( \) is the solution of the polynomial equation

\( \) the subset of Lie algebra structures on \( \Lambda \) is denoted by \( \Lambda \)
category of K-Y-algebras.

Of course the category of associative algebra is a sub-category of the Koszul-Vinberg algebra (or K-Y-algebra) if

\[ \Lambda \ni (m, n, \Lambda) = (m, n)^\Lambda \]

Definition 0.4. An asymmetric algebra \( \Lambda \) is called Koszul-Vinberg anomaly of \( A \) defined by

\[ \Lambda \ni (m, n, \Lambda) = \Lambda(m, n, \Lambda) = (m, n)^\Lambda \]

Consider the function \( \Lambda \ni (m, n, \Lambda) = (m, n)^\Lambda \).
0 = (m', \nu, n)^{\eta[\cdot]} \quad \text{Hint: Verify by direct calculations that}\]

algebra.

\(\Lambda \in \mathcal{A}\) is a Lie \(\Lambda \in \mathcal{A}\) is a Lie then \(\forall \lambda \in \Lambda, \nu \in \Lambda, (\nu, \lambda)_{\eta} - (\lambda, \nu)_{\eta} = \eta[\nu, \lambda]\)

Proposition 0.6 Let \(\Lambda \in \mathcal{A}\) be a K-Y-algebra and set
25 (1977)

commutator Lie algebra is $\mathfrak{g}$ is widely open. [1, Milnor, Advanced Math.

know whether there exists an $n$—dimensional $K$-algebra $A$ whose

Remark 0.8 Given a Lie algebra of dimension $n$ say $\mathfrak{g}$, the question to

commutator Lie algebra of the $K$-algebra of $A$.

Definition 0.7 The Lie algebra $A_l$ in the proposition above is called
The relationship above implies Proposition 06.

\[(m', n') \otimes_X \mathcal{E} = (m', n') \otimes \bigwedge^k \mathcal{K} \bigwedge \mathcal{L} \ \forall \ \mathcal{K} \text{-anomaly \ \bigwedge^k \mathcal{L}

The Jacobi anomaly \ \bigwedge^k \mathcal{L} \text{ is related to the}

\[\forall \ \mathcal{L} \in \mathcal{L}, \ \forall \ \mathcal{n} \mathcal{A} (n^n) \otimes (n^n) \otimes \Lambda = \mathcal{n} [\mathcal{L}]

defined by

\[\mathcal{n} [\mathcal{L}, \mathcal{A}] \text{ is the multiplicative where the multiplicative } \mathcal{A} \bigwedge \mathcal{L} = \mathcal{A} \bigwedge \mathcal{L} \text{ is assigned the commutator algebra } \mathcal{A}.

Remark 0.9 To every asymmetric algebra \[\mathcal{A} \] is assigned the
The set of Jacobian elements of \( A \) is denoted by \( J(\Lambda) = A \).

\[
\forall \Lambda \in \mathbb{A} \forall \eta \in \mathbb{N} \exists \nu \text{ if } A \text{ is an symmetric algebra } A \text{ and } \Lambda \text{ is called Jacobian element of an } \nu \leq 0.
\]
\[ \cdots \xrightarrow{p} 1 + b \mathcal{O} \xrightarrow{p} b \mathcal{O} \xrightarrow{p} 1 - b \mathcal{O} \xrightarrow{p} \cdots \]

If \( \epsilon = 1 \) then \( p \) is called coboundary operator of the sequence.

\[ \{1, 1\} \in \mathcal{E} \text{ with } \mathcal{A} = b \mathcal{O} \subset (b \mathcal{O}) p \text{ and } 0 = p \circ p \]

The space \( \mathcal{O} \text{ with a linear operator } d \text{ satisfying } \mathcal{O} \leftarrow \mathcal{O} \) is a graded vector space.

**Definition 0.11** A complex of vector spaces is a \( \mathbb{Z} \)-graded vector space.

We focus on complex of vector spaces.
\[ \cdots \xrightarrow{p} 1 - b \mathcal{C} \xrightarrow{p} b \mathcal{C} \xrightarrow{p} 1 + b \mathcal{C} \xrightarrow{p} \cdots \]

If \( p \) is called boundary operator of the sequence \( \mathcal{C} \), then \( \mathcal{C} \) is a cohomology space of \( \mathcal{C} \). If \( \mathcal{C} \) is the quotient space \( \mathcal{C}_b B / (\mathcal{C})_b Z = (\mathcal{C})_b H \), then \( \mathcal{C} \) is called a \( b \)-cocycle, the quotient space \( \mathcal{C}_b B \) is called a \( b \)-coboundary, an element of \( \mathcal{C}_b B \) is called a \( b \)-cohomology class. We have

\[ (1 + b \mathcal{C} \xrightarrow{p} b \mathcal{C} : p) \text{ for } y \in (\mathcal{C})_b Z \text{ and } (1 - b \mathcal{C} p = (\mathcal{C})_b B \text{ set} \]
Strong geometrical meanings.

Next three subsections are devoted to some complexes which have

$$\mathcal{O}^b B / \mathcal{O}^b \mathbb{Z} = \mathcal{O}^b H$$

The homology space of $\mathcal{O}$ is the $b$-cycle; clearly one has

$$\mathcal{O}^b \mathbb{Z} \subset \mathcal{O}^b B$$

The quotient is called a $b$-cycle; clearly one has

$$\mathcal{O}^b B$$

An element of $\mathcal{O}$ is called a $b$-boundary; an element of

$$\mathcal{O}^b \mathbb{Z} \subset (1 + b \mathcal{O}) \mathcal{P} = \mathcal{O}^b B$$

$$\begin{pmatrix} 1 - b \mathcal{O} & b \mathcal{O} : p \end{pmatrix}_{p \in \mathcal{P}} = \mathcal{O}^b \mathbb{Z} \text{ and } b \mathcal{O} \subset (1 + b \mathcal{O}) \mathcal{P} = \mathcal{O}^b B$$
\[ M \in mA, \forall \in q, qA (q' (a, m) \chi) \chi = ((q, m) \chi, \chi) \]
\[ (q, a, m) \chi = (q' (a, m) \chi) \chi \]
\[ (m, q') \chi = ((m, q) \chi, \chi) \chi \]

The conditions satisfying \( M \leftarrow A \times M \) and \( M \leftarrow M \times A \) by a vector space \( M \)

**Definition 0.12** A bi-module over \( A \) is a vector space \( M \) with two bilinear maps \( \chi \) satisfying:

\[ (a, n) \eta = an \]

When there is no risk of confusion we set 

\[ \forall A \in m^n, \forall \eta, n A 0 = (m', n) \eta \]

Application (Konstischn) Let \( A, (\eta, A) \) be an associative algebra. i.e.

\[ \Rightarrow \] Hochschildd complexes of associative algebras
\[ w - mw = (v)m \phi \]

is defined by \((M, ^{\bigwedge} \mathcal{A})_{+} \bigoplus \mathcal{C} \) for \( m \mathcal{C} \in \mathcal{A} \) and \( m \mathcal{C} \in \mathcal{A} \).

Let \((M, ^{\bigwedge} \mathcal{A})_{+} \bigoplus \mathcal{C} \) as follows. Let operator \( p : \mathcal{A} \to \mathcal{C} \).

Now we denote the linear form \( \mathcal{A} \) by \( \beta \mathcal{A} \). \( (M, ^{\bigwedge} \mathcal{A})_{+} \bigoplus \mathcal{C} \) = \((M, ^{\bigwedge} \mathcal{A})_{+} \bigoplus \mathcal{C} \).

\( M = (M, ^{\bigwedge} \mathcal{A})_{+} \bigoplus \mathcal{C} \),

\( 0 > b f \), \( 0 = (M, ^{\bigwedge} \mathcal{A})_{+} \bigoplus \mathcal{C} \).

where \((M, ^{\bigwedge} \mathcal{A})_{+} \bigoplus \mathcal{C} \). This graded vector space \( \mathcal{C} \) is considered.

Hochschild \( M \) -- valued cohomology complex. We consider the notation: From now we shall set \( \mathcal{A} \).
The cohomology of the complex above is the Hochschild cohomology

\[ \mathcal{M} \mathcal{A} \leftarrow_p \mathcal{M} \mathcal{A} \leftarrow_p \mathcal{M} \mathcal{A} \leftarrow_p \cdots \leftarrow_p \mathcal{M} \mathcal{A} \leftarrow_p \mathcal{M} \mathcal{A} \]

We get the cohomology complex

\[ H^n = 0. \]

Proposition 0.13

\[ (I+b_D, \ldots, I+\ell_D) f' \ell (I-) I=\ell \leq b \]

\[ + I+b_D ((b_D, \ldots, I_D) f') I+b (I-)+ \]

\[ + (I+b_D, \ldots, I_D) f I_D = (I+b_D, \ldots, I_D) f \]

Let \( (\mathcal{M} \mathcal{A}) \leftarrow_p \mathcal{M} \mathcal{A} \mathcal{O} \) denote the \( \mathcal{O} \) then the map with \( (\mathcal{M} \mathcal{A}) \mathcal{O} \mathcal{O} \) is denoted by \( f_p \)
\[ [\mathbf{g}, f] \eta + [\eta, f] \mathbf{g} = [\eta \mathbf{g}, f] \]

satisfying the condition

Definition 0.14 A Poisson structure on \( M \) is a Lie algebra structure on \( \mathfrak{X}(M) \).

An associative commutative algebra.

Then \( C^\infty(M, \mathbb{R}) \) is a manifold. We endow \( C^\infty(M, \mathbb{R}) \) with the usual function on a manifold. Let \( C^\infty(M, \mathbb{R}) \) be the space of real-valued smooth

An application.
\[
\frac{\tau}{(f^\ast b)\theta + (b^\ast f)\theta} = (\theta, f)\theta S \quad \text{and} \quad \frac{\tau}{(f^\ast b)\theta - (b^\ast f)\theta} = (\theta, f)\theta V
\]

where \((\mathbb{R}, \mathbb{W})_\infty \subseteq \mathbb{R}, f \mathbb{A} (\theta, f)\theta S + (\theta, f)\theta V = (\theta, f)\theta\)

is decomposed as it follows

\[(\mathbb{W})_\infty \subseteq \mathbb{W}, f \mathbb{A} \mathbb{W})_\infty \subseteq \mathbb{W}, f \mathbb{A} \mathbb{W})_\infty \subseteq \mathbb{W}\]

Every coefficient in itself, every

let \(C \mathcal{H} \) be the hochschilb complex of

\[(\mathbb{W})_\infty \subseteq \mathbb{W}, f \mathbb{A} \mathbb{W})_\infty \subseteq \mathbb{W}, f \mathbb{A} \mathbb{W})_\infty \subseteq \mathbb{W}\]
on $M$. Define a Poisson structure (iii) the multiplication $\theta_{\ast} [g, f] = \theta_{\ast} (g \cdot f) \triangledown$.

$$\left( (W, \mathcal{C}_\infty (\mathbb{R}), \mathcal{C}_\infty (\mathbb{R})) \right) \in \theta_{\ast} S \quad (\text{ii})$$

$$\left( (W, \mathcal{C}_\infty (\mathbb{R}), \mathcal{C}_\infty (\mathbb{R})) \right) \in \theta_{\ast} Z \quad \text{\text{Every}}$$

Theorem 0.15 ([Kontsevich]) For every
\begin{align*}
(1 + b) \star f &= 1 \star (b \star f) & \text{satisfy } \frac{1}{0} \frac{1}{\infty} + \frac{1}{b} f &= b \star f \\
\forall \theta \in T_{10}^0 \infty & \exists \theta \in T_{10}^0 \infty \\
(\mathbb{R}, \mathcal{W})_{\infty} \ni & \forall \theta \in T_{10}^0 \infty \\
\text{with } \forall \theta \in T_{10}^0 \infty & \exists \theta \in T_{10}^0 \infty \\
\text{quanzitable (existence of star product). I.e there exists a formal } & \\
\text{series}\text{(quantizable) The associative } & \\
\text{Theorem 0.17 (Kontsevich)} & \\
\text{contains one and only one Poisson tensor.} & \\
\text{Exercise 0.16 Every class } H \ni [\theta] & \\
\text{is } & \\
\text{contains one and only one Poisson tensor.} & \\
\text{Exercise 0.16 Every class } H \ni [\theta] & \\
\text{is } & \\
\text{contains one and only one Poisson tensor.} & \\
\end{align*}
\[ M \in \mathfrak{m} \mathfrak{A} \quad \delta \in \mathfrak{q} \mathfrak{v} \mathfrak{A} \quad (m, (q, v) n') Y = ((m, v) Y, q') Y - ((m, q) Y, v') Y \]

with a bilinear map \( \delta : M \times \mathfrak{g} \rightarrow \mathfrak{m} \) satisfying the identity.

**Definition 0.18** A module over the Lie algebra \( \mathfrak{g} \) is a vector space \( \mathcal{W} \). A module over the Lie algebra \( \mathfrak{g} \) is a vector space \( \mathcal{W} \) with a bilinear map \( \delta : \mathcal{W} \times \mathfrak{g} \rightarrow \mathcal{W} \) satisfying the identity.

Algebra whose Jacobi anomaly vanishes identically.

Algebra, according to the previous notation (notation \( n^l_A \)), is a skew symmetric algebra. According to the previous notation (notation \( n^l_A \)), let \( \delta \) be a Lie (Fried-Goldman-Hirsch-Radiceanu class) let \( \delta \) be a Lie application. Application \( \delta \) — algebra.
\[ (M', \mathcal{B}_b V)^{\omega_0} H = (M', \mathcal{B})_b \mathcal{C} \]

and \[ M = (M', \mathcal{B})_0 \mathcal{C} 0 > b A 0 = (M', \mathcal{B})_b \mathcal{C} \]

Consider the \( \mathbb{Z} \)-graded vector space \( (M', \mathcal{B})_b \mathcal{C}^b \oplus = (M', \mathcal{B})_\mathcal{C} \)

\[ (m, \varphi) \lambda = m \varphi \quad (q, \varphi) \eta = [q, \varphi] \]

To simplify our notation let us set
\[
\left( b \rho', \ldots, \rho', \ldots, \left[ \ell \rho, \rho, \rho \right] \right) f_{\ell + \rho} \left( I - \right)^{\ell} \Xi \\
+ \left( b \rho, \ldots, \rho, \ldots, 0 \rho \right) f_{\rho} \left( I - \right)^{0} \Xi = \left( b \rho, \ldots, 0 \rho \right) f_{\rho}
\]

is defined by

\[
\left( M, \mathcal{B} \right)_{\ell + b} \circ \in \Sigma \left( M, \mathcal{B} \right)_{b} \circ \in \Sigma \left( M, \mathcal{B} \right)_{0} \circ \in \Sigma \left( M, \mathcal{B} \right)_{0} \circ \in \Sigma \left( M, \mathcal{B} \right)_{0} \circ \in \Sigma
\]

as follows with the coboundary operator d.

The Chevalley-Eilenberg-Koszul complex of the Lie algebra g with coefficients on the Z-module W is the complex of the Lie algebra g with coefficients on the Z-module W.
if its Killing is regular (i.e. $B$ is non degenerate).

Definition 0.20 A finite dimensional Lie algebra $\mathfrak{g}$ is called semi-simple symmetric and bi-invariant.

The Killing form is $-(\text{trace}(B)) = \langle B, \cdot \rangle$. The Killing form $B$ form defined by $B(a, b) = \text{trace}(B(a \otimes b))$.

Suppose that $\dim B_m = n$. To every element $a \in B$ is associated the linear map $\mathfrak{g} \ni q \mapsto \langle q, a \rangle \in \mathbb{C}$. To every every module over itself under the bilinear map denoted by $H(\mathfrak{g}, \mathfrak{g})$.

Notation: the complex cohomological space of the complex $\mathfrak{g}$ is $H^*_\mathcal{C}(\mathfrak{g})$. Of course every every
0 \neq (M, B)_{\exists H} \text{ then } 0 = \chi \forall H (\forall) \bullet

0 < b \land 0 = (M, B)_{\forall H} \text{ then } 0 \neq \chi \exists H (\exists) \bullet

M \leftarrow M \times G : \chi

dimensional semi-simple Lie algebra g under the linear map

Theorem 0.21 Let M be a finite dimensional module over a finite dimensional semi-simple Lie algebra g under the linear map.
Theorem 0.22 (Koszul): Given a finite dimensional real Lie algebra, the forms $H^3(g, \mathbb{R})$ is isomorphic to the space of bi-invariant symmetric bilinear forms.

The claim of (ii) is a direct consequence of the following...
$$O = (\begin{bmatrix} q' & a \end{bmatrix}) b - (p)b(q) \chi - (q)b(p) \chi$$

This is a cocycle of $C(M, \mathcal{B})$. That is, $\mathcal{B}$ is a module under a bilinear map $\chi$.

The following conditions follow:

- There is a bilinear map $\chi$ such that
- $\mathcal{M} \hookrightarrow \mathcal{B}$ and a linear map $\mathcal{M} \hookrightarrow \mathcal{M} \times \mathcal{B}$.

This means the following are bilinear maps on the space $\mathcal{M}$: Let $\mathcal{B}$ be a Lie algebra acting affinely on a vector

An application: Let
Theorem 0.23. The cohomology class $[b]$ vanishes if the affine $(\mathfrak{g}, \chi)$ has a fixed point $(\mathfrak{g}, \chi) + (m, \mathfrak{g}) \leftarrow (m, \mathfrak{g})$

of the application $M \leftarrow M \times \mathfrak{g}$

The cohomology class $(M, \delta)_H \in [b]$ is called the radiance class.
closely related to the Koszul Cohomology of the symbol $\mathcal{W}$. The question to know whether is formally integrable is manifold $\mathcal{W}$. For instance, let be a system of partial differential equations on a complex which plays a deep role in global analysis on manifolds. We plan to introduce a Koszul-Spencer Complex of linear spaces.
Exercise 0.24: Verify that \( \mathcal{M} \otimes \Lambda^* \subset \Lambda^* \Lambda \). For every \( \lambda \in \mathbb{N} \), set \( \Lambda^* = \mathcal{M} \otimes \Lambda^* \Lambda \). For every \( \lambda \in \mathbb{N} \), let \( \Lambda^* \Lambda \) be the space of \( \Lambda \)-linear maps from \( \mathcal{M} \otimes \Lambda^* \Lambda \) to \( \Lambda \), for \( \lambda \in \mathbb{N} \). For \( \lambda \in \mathbb{N} \), let \( \Lambda^* \Lambda \) be the subspace of \( \Lambda \)-linear maps from \( \mathcal{M} \otimes \Lambda^* \Lambda \) to \( \Lambda \). Let \( \Lambda \) and \( \mathcal{M} \) be two finite-dimensional vector spaces and let \( \mathcal{M} \) be a
\forall A, 0 \leq lA, \exists \Lambda_1 V = (\mathbb{R})_{q, l} \mathcal{C} \\
\forall lA, 0 \leq \mathbb{M} \otimes \Lambda_1 V = (\mathbb{R})_{1 - l} \mathcal{C} \\
1 \rightarrow \forall A, lA, 0 = (\mathbb{R})_{q, l} \mathcal{C} \\
\forall A, 0 > lA, 0 = (\mathbb{R})_{q, l} \mathcal{C} \\

We define the bigraded vector spaces as follows:
the notation is easily understood.

This is: \((1, \ldots, \lambda)_{\text{Hom}} H \supset (1, \ldots, \lambda) \in (1, \ldots, \lambda) f\)

The right member of the formula above has the following meaning:

\[
(\lambda) \left( (1 + \lambda, \ldots, \lambda^r, \ldots, 1 + \lambda) f \right) \bigwedge_{1 + \lambda}^{1 = \lambda} = (1 + \lambda, \ldots, 1 + \lambda) f \in \Omega
\]

follows as defined as:

\[
(\lambda \otimes \Lambda_{1 + \lambda} V)_{\text{Hom}} H = (\lambda) \otimes \Lambda_{1 + \lambda} V
\]

Given \(\in \Omega\) in degree \((-1, -1, \ldots, -1)\). Given the following operator with the following graded space

We endow the bi-graded space with the following operator
Koszul-Spencer cohomology space of \( z \).

\[
\mu, (I, k, \mathcal{C}) (I, \mathcal{C}) / (I, \mathcal{C}) \mathcal{B} \mathcal{H} \mathcal{V} Z = (I, \mathcal{C}) \mathcal{C} \mathcal{H} \mathcal{V} \mathcal{B} / (I, \mathcal{C}) \mathcal{H} \mathcal{V} Z \]

The space \( (I, \mathcal{C}) \mathcal{H} \mathcal{V} Z \) is isomorphic to \( (I, \mathcal{C}) \mathcal{H} \mathcal{V} Z \).

The sequence is a cohomology complex, that is to say, is trivial. This sequence is a cohomology complex, that is to say, is trivial.
Historically, the complex $\mathcal{C}(\mathfrak{m})$ has been discovered by D. Spencer. It is known as Spencer linear complex. By dualizing the complex $\mathcal{C}(\mathfrak{m})$ with one gets the complex $\oplus_{\ell,k} \mathcal{C}_{\mathcal{L},k}(\mathfrak{m})$ with $\mathcal{C}_k(\mathfrak{m}) \wedge_k \mathcal{V} \otimes (\Lambda^2 \mathcal{L} \otimes \Lambda^k \mathcal{V})^* \subset \mathcal{H} \wedge_k \mathcal{V} \otimes \mathcal{W}^*$. Michel Nguifo Boyon, septiembre 04th to 16th, 2006.
Mathematische, Jerusalem 1965

Singer-Steinberg: The Infinite Groups of Lie and Cartan. Your Analysis
Koszul complexes. This result is due to Alexander Grothendieck [ct]
which is a Koszul complex. Thus linear Spencer complexes are dual of

\[ \cdots \xleftarrow{\varphi} V_{I+1} \xleftarrow{\varphi} \cdots \]

\[ (\gamma \Psi^*) = \gamma \Psi \]

The boundary operator \( \varphi \) is the transpose
tiber \mathcal{A}_x of \mathcal{A} is included in $\mathcal{S}_x \otimes M \times \mathcal{L}_x^* \otimes \mathcal{L}$. This is the geometric symbol of $\mathcal{D}$. The

Denote by $\mathcal{E}_y \otimes \mathcal{E}_y$ the kernel of the natural projection $\Pi^{\mathcal{L}}_y \otimes \mathcal{L}_y$ on $\mathcal{E}_y \otimes \mathcal{E}_y$. Let $\mathcal{E}_y \otimes \mathcal{E}_y$ be the sections of $\mathcal{E}$. Let $\mathcal{E}_y \otimes \mathcal{E}_y$ be valued functions define on the manifold $\mathcal{D}$. The operator $\mathcal{D}$ of order $k$ on the trivial bundle $\mathcal{E} \otimes \mathcal{E}$ be a valued differential operator $\mathcal{D}$ let $\mathcal{D}$ be a valued differential operator

An relevant application
classical Schwarz Lemma.

Remark 0.26 The condition \( H_0 = 0 = \{ x \} \) is formal integrable at \( x \).

Theorem 0.25 If \( 0 = \{ x \} \) is formal integrable at \( x \), then the equation

\[
\left\{ x \right\} \otimes W^x \mathbb{L}_d V = \left( x \right) b^d \mathcal{C}
\]

with

\[
\left( \mathcal{D} \left( x \right) b^d \mathcal{C} \right)^b \mathcal{D} \oplus
\]

the Spencer complex is contained in \( \Omega \mathcal{R}_1 \otimes W^x \mathbb{L}_d V \). Thus at each \( x \in \mathcal{W} \), it is the first prolongation of \( D \), then its geometric symbol \( \mathcal{W}_1 \) is
The set $\mathcal{A}(\mathbb{R})$ contains the following sub-varieties: $\mathcal{A}^{sg}(\mathbb{R})$.

Let us set

\[ \mathfrak{K}_{\mathbb{R}} = \mathbb{R} \otimes \otimes \{ \mathbf{u} \in \mathbb{R}^n \text{ structures on } \mathbb{R} \mathfrak{A} \} = (u)\mathfrak{A} \]

Algebraic Geometry of Algebraic Structures
The natural action of the linear group preserves all $(u)^{T} \subset (u)^{ss} \subset (u)^{\nabla}$.

Moreover, one has the following inclusions

All of these sub-varieties are singular algebraic varieties.

Consider the cohomology of the geometry of $A^{r}$.

Our aim is to point out the role played by the sub-varieties. Our aim is to point out the role played by the sub-varieties.
$O \leftarrow M \leftarrow L \leftarrow \Lambda \leftarrow 0$

$A$–bimodules

An extension of $\Lambda$ by $V$ is an exact sequence of $A$–algebras. An extension of $M$ by $\Lambda$ is an exact sequence of the same associative algebras respectively.

Definition 0.27 Let $V$, $W$, $\Lambda$, $M$ be two bimodules over the same associative $A$–algebras for the $A$–algebras and for $K$.

$\text{Sub-varieties of } A(n)$
Theorem 0.29 There is one-to-one correspondence between the set of maps from \( M \) to \( \Lambda \) an \( \Lambda \)-module as well.

Given two \( \Lambda \)-modules \( M \) and \( \Lambda \), the vector space \( (\Lambda, M)^T \) of linear maps from \( M \) to \( \Lambda \) is an \( \Lambda \)-module as well.

\[
\begin{array}{ccc}
M & \leftarrow & \Gamma \leftarrow \Lambda \\
\uparrow\phi & & \uparrow\phi \\
M & \leftarrow & \Gamma \\
\end{array}
\]

This diagram is commutative.

When two extensions \( \mathcal{L} \) and \( \mathcal{L}' \) are equivalent, we have the following:

Inducing the identity map on \( \Lambda \) and on \( M \) respectively.

Equivalent if there exist \( \Lambda \)-module isomorphisms \( \phi \) and \( \phi' \) of \( \mathcal{L} \) and \( \mathcal{L}' \) respectively.

Definition 0.28 Two extensions of \( M \) by \( \Lambda \), say \( \mathcal{L} \) and \( \mathcal{L}' \), are
Theorem 0.32. There is one-to-one correspondence between the set of identity on \( \Lambda \) and on \( A \) respectively.

There exists an algebra isomorphism \( \varphi \) from \( B \) to \( B' \). Inducing the two extensions \( B \) and \( B' \) by \( A \) are equivalent if

\[ 0 \leftarrow A \leftarrow B \leftarrow \Lambda \leftarrow O \]

Definition 0.31. Two extensions \( B \) and \( B' \) of \( A \) by \( \Lambda \) and \( A \) by \( \Lambda \) are equivalent if

an exact sequence of algebras

Definition 0.30. An extension of the algebra \( A \) by the null algebra \( \Lambda \) is map is zero (null algebra).

Now we consider a \( A \)-module \( \Lambda \) as an algebra whose multiplication

\[ ((\Lambda, M), T, A) \]

cohomology space
The set of equivalence classes of extension of $G$ by $\mathcal{V}$ and the abelian Lie algebra, then there is one-to-one correspondence between algebra Lie algebra $G$. Consider $V$ as

\[ (\text{Cohomology space } \mathcal{H}_2(\mathcal{V}, \mathcal{A})) \]

Theorem 0.34. Let $V$ be a module over a Lie algebra $G$. Consider $V$ as cohomology space.

Theorem 0.33. Given two modules $\mathcal{V}$ over same Lie algebra $\mathcal{A}$, Chevalley-Eilenberg cohomology by algebras by Lie algebras and by replacing Hochschilid cohomology by multi-at modules we have similar statements by replacing associative cohomology space.

\[ (\text{Cohomology space } \mathcal{H}_2(\mathcal{V}, \mathcal{A})) \]
to appear in PJM)

Involves more sophisticated tools (i.e., namely, spectral sequences, ct. MNB

the study of the extension problem for modules over K-algebras

results are different from what one would expect. Roughly speaking,

One will see that in the case of K-algebras and their modules the

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• Relationship with the homological algebras

\( \text{GL}(\mathbb{R}^n) \) - dynamic in \( \mathfrak{A}(n) \)
preserved by the natural actions of $\mathbb{G}^{\infty}_{\mathbb{R}}$ on $\mathcal{A}^\infty$.

We have already remarked that all of $\mathcal{A}$ and $\mathcal{I}$.
multipliication is $\mathcal{H}$. The orbit $\mathcal{O}(u)$ is the isomorphism class of $A$. Given a $\rho \in \mathfrak{A}$, let $A(u)^{\text{ass}}$ be the associative algebra whose
In other words, if \( \eta \in C^0 \), \( \forall \lambda \in (\mathbb{N}, \mathbb{N}) \), then by setting 

\[
\eta^0 = \left. \frac{\partial}{\partial t} \right|_{t=0} (\frac{q(t) \eta}{p(t)})
\]

\( \eta \) is differentiable at \( t=0 \), then 

\[
(0, p) (\frac{q(t) \eta}{p(t)}) = (0, q) (\frac{q(t) \eta}{p(t)})
\]

For \( a, b, c \in \mathbb{N} \), we have 

\[
\forall \lambda \in (\mathbb{N}, \mathbb{N}) \ni \eta \ni \eta^0, \quad \text{such that} \quad t \geq 0 \geq t.
\]

Let us consider a path \( \eta^0 \ni \eta \ni \eta^0, \quad \forall \lambda \in (\mathbb{N}, \mathbb{N}) \ni \eta \ni \eta^0, \quad \text{such that} \quad t \geq 0 \geq t.
\]
Thus \( (q',\alpha)\pi p = (q',\alpha)^0 \).

Therefore

\[
(q')^\pi \alpha = (q',\alpha)^0 \pi = ((q',\alpha)^0)^\pi = (q',\alpha)^0 \pi
\]

Since \( \mathcal{H} \subset (q,\alpha) \mathcal{H} \), then

\[
\forall \alpha \in \mathcal{H} \quad (q')^\pi \alpha = (q',\alpha)^0 \pi
\]

If \( (q')^\pi \mathcal{H} \subset \mathcal{H} \), then there is a path \( \mathcal{H} \subset (q')^\pi \mathcal{H} \).
Theorem 0.35 If \( \mathcal{H} \) is the \( \mathbb{R} \) vector space of the \( \mathcal{H} \) measures, how measures the Hochschild cohomology space \( \mathcal{H} \)? Roughly, \( (u)_{\mathcal{H}} \) is the \( \mathcal{H} \) subspace of tangent vectors at \( u \) to \( \mathcal{H} \), while the tangent space at \( u \) to \( \mathcal{H} \), say \( (u)_{\mathcal{H}} \), is \( (u)_{\mathcal{H}} \). Summarizing calculations above, one easily sees that the Zarski...
\[
\begin{align*}
\left((c, (q, a))^n\right)^n - \left((c, (q, a))^n\right)^n + \left((c, (q, a))^n\right)^n - \left((c, (q, a))^n\right)^n = (c, (q, a))^n \bullet \gamma
\end{align*}
\]

As it follows, we define \( \mathcal{A}(\mathcal{A}, \mathcal{A}) \) with \( \mathcal{A} \) is Hochschild complex is denoted by

\[
\mathcal{A}(\mathcal{A}, \mathcal{A}) \subset \mathcal{A} \cap \mathcal{A}, \forall q \in \mathcal{A}, (q, a)^n = a^n
\]

When \( \mathcal{A} \) is the associative algebra whose multiplication is \( \mu \), let us set

\[
\mathcal{A}(\mathcal{A}, \mathcal{A}) \subset \mathcal{A} \cap \mathcal{A}, \forall q \in \mathcal{A}, \mu^n \cdot \cdots + \mu^n + \cdots + \mu^n + \cdots + \mu^n = \mu^n
\]

Keeping the notation used above, we consider a power series
Theorem 0.36 Let $A$ be an associative algebra whose multiplication is then $I'$ is prequantizable.

denoted by $I$. If the Hochschild cohomology space $H^3(A, A)$ vanishes,

As a consequence of the system above one has

$$\text{(4)}_{\ast} \quad 0 = (\ast_{\ast})_{\ast} \sum_{\ast} = \ast_{\ast} \ast \quad 0 = \ast_{\ast} \ast$$

Direct calculations show that $\ast$ satisfying the following system

$$0 = (\ast_{\ast})_{\ast} \sum_{\ast} \ast \ast \ast + \cdots \ast \ast + \cdots + \ast \ast \ast + \cdots + \ast \ast = \ast \ast$$

We shall say that $I'$ is prequantizable if there exists a power series
• Relationship with the homological algebras

\text{Deformation of } \mathcal{A}(n)
The set of deformations of $\mathcal{A}$ is an algebraic subset of $\mathfrak{u}(\mathcal{A})$. Indeed, let structure

the new multiplication $ab + \theta(ab)$ defines an associative algebra such that

Definition 0.37 A deformation of $\mathcal{A}$ is an element $\theta \in \mathfrak{u}(\mathcal{A})$ such that $\theta$.

Let $\mathcal{A}$ be an $n$-dimensional associative algebra, whose multiplication is

cohomology complex $C(\mathcal{A}, \mathcal{A})$.

As the space of $2$-cochains of the Hochschild
Therefore \((\forall \theta, \varphi')(\forall \theta, \varphi')\theta = \theta\).

Therefore \((\forall \theta, \varphi')(\forall \theta, \varphi')\theta + \theta = (\forall \theta, \varphi')(\forall \theta, \varphi')\theta\).

This means that for every \(\theta\) in the real interval \([0, 1]\), \((\forall \theta, \varphi')(\forall \theta, \varphi')\theta\) lies in \(A^g\).

For instance suppose that the straight Hochschild complex \((\forall \theta, \varphi')(\forall \theta, \varphi')\theta\) involves the understanding of its "local" combinatorial structure involves the set of deformations of \(\theta\) is not a convex set. As one sees the cohomological equation subject to \(\theta\) are cochains of \(A\).
Theorem has the following consequence.

This is nothing else than the rigidity theorem. The rigidity in \( A^{\gg n} \) of \( H \)-orbits of \( A \) is Zariski open space. Thus if the Hochschild cohomology of the Hochschild complex of \( A \) is nothing but the space of 2-cocycles of 2-orbits of \( A \). The set of trivial infinitesimal deformations of \( A \) is called trivial when it is tangent to \( \mathcal{Z} \). Moreover the associator of 0 variances identically. Thus the space
whose multiplication is \( l + t(l) + t^n(l) \) is isomorphic to \( A \), included in \( \text{Ass}(n) \). Then for any \( t \) in the real interval \( (0, 1) \), the algebra \( \mathbb{H}^2 \) vanishes. If the straight interval \( (0, 1) \) is multiplied by \( H \), then suppose that the Hochschild cohomology space \( H^n \) exists. Let \( H^n \subseteq \text{Ass}(n) \) and suppose that the Hochschild cohomology space \( H^n \) exists. Let \( A \) be an \( n \)-dimensional associative algebra whose

Theorem 0.38
0 = (\mathcal{C}, q, p) \theta f + (\mathcal{C}, q, p) \theta p + (\mathcal{C}, q, p) \theta f 

whose Jacobi anomaly is related to its coboundary according to the symmetric 2-cochain of the Chevalley-Eilenberg complex of the Maurer-Cartan element of Lie algebra \mathcal{C} is a skew-Hochschild complex \( \mathcal{C}(A, A) \). 

We will be called the set of Maurer-Cartan elements of the associative algebra A. Because the deformation equations look like the Maurer-Cartan equation, the set of deformations of an associative
to the third cohomology space. We have pointed that prequantization is related called prequantization. We have pointed that prequantization is related.

A formal deformation deformation of an algebra structure is what we have explained. Explain why semi-simple Lie algebras are rigid.

Chevalley-Eilenberg complex $\mathcal{C}(G, \mathcal{C})$. The algebra $G$ and the set of Maurer-Cartan elements of the set of deformations. There is a one to one correspondence between the set of deformations...
Theorem. The case of $K$-algebras and their module. We recall the

Every Restrict Deformation Theory Generates Its Proper Cohomology

known as a conjecture of Gerstenhaber is the following statement.

Following M. Gerstenhaber this strong relationship between

Deformation quantization by Kontsevich

complexes and prequantization. What we call prequantization is called

cohomology complexes and deformation theory. Cohomology

relationships between cohomology complexes and extension problems;

in the previous subsections we have been interested in some strong

Conjecture of Gerstenhaber
The notion of bimodule over a KV-algebra has been defined. Given a bimodule \( \Lambda \) over a KV-algebra \( A \), an element \( \in \Lambda \subseteq A \) is called Jacobi if \( n(qa) = (nq)a \), for all \( q \in A \). The subset of Jacobi elements is denoted by \( J(\Lambda) \).

An algebra whose Koszul-Vinberg anomalies vanishes identically is called Koszul-Vinberg algebra (or KV-algebra).

**Definition 0.39** An algebra \( \mathfrak{g} \) is a KBV-algebra if its Koszul-Vinberg anomalies vanish.
$\text{If } b \text{ is positive, then } (\Lambda, b \otimes A)_{\text{hom}} H = (\Lambda, A)_{\mathcal{C}}$

$\text{and } (\Lambda)_{\mathcal{P}} = (\Lambda, A)_{\mathcal{C}}$

$\text{If } b \text{ is negative, then } O = (\Lambda, A)_{\mathcal{C}}$

Consider the $Z$-graded vector space $\bigoplus (\Lambda, A)_{\mathcal{C}}^b$
The KY-cohomology theory lectures are devoted to some relevant applications of the KV- diagrams and their modules, (of MNB to appear in P.M.) Next above solves the conjecture of Gershenhaber for the category of the deformation theory the cohomology derived from the KV-complex in regard to \( (I + b \cdot (\mathcal{L} \cdot \cdots \mathcal{L} \cdot I \mathcal{L} \cdot \cdots \mathcal{L} \cdot I \mathcal{L} - \mathcal{L} \cdot \cdots \mathcal{L} \cdot I \mathcal{L} \cdot \cdots \mathcal{L} \cdot I \mathcal{L} + \mathcal{L} \cdot \cdots \mathcal{L} \cdot I \mathcal{L} \cdot \cdots \mathcal{L} \cdot I \mathcal{L}))_f(I-1) + b > \frac{f}{2} = (I + b \cdot (\mathcal{L} \cdot \cdots \mathcal{L} \cdot I \mathcal{L} \cdot \cdots \mathcal{L} \cdot I \mathcal{L})_f). \)

If \( b \) is positive, let \( \Lambda \) be defined by \( (\Lambda \cdot \mathcal{V})_I \in b \cdot \mathcal{O} \in \mathcal{F}_I \). Then with \( \Lambda \cdot \mathcal{V} \in \mathcal{O} \cdot \mathcal{V} \) the following coboundary operator is defined with the following values in \( \mathcal{A} \) with \( \Lambda \cdot \mathcal{V} \in \mathcal{A} \) as the graded space just defined.

The KY-complex of \( \mathcal{A} \) with values in \( \Lambda \) is the graded space just defined.
The universal covering of \( (D, W) \) is denoted by \( \tilde{D}, \tilde{W} \).

Curvature tensor vanishes identically.

Linear a torsion free linear connexion (on the manifold \( M \)) whose

A locally flat manifold is a pair \( (D, W) \) where \( D \) is a

Definition 0.40 A locally flat manifolds

Locally flat manifolds

Geometry
The vector space of smooth vector fields on a locally flat manifold is a K-algebra whose multiplication is defined by

\[ \mathcal{A}^X \mathcal{D} = \mathcal{A}X \]

The canonical Einstein linear connection on \( \mathbb{R}^n \)

convex domain in \( \mathbb{R}^n \) not containing any straight line and is the hyperbolic \( \mathcal{U} \cup \mathcal{D} \) is diffeomorphic to some \( \mathcal{U} \cup \mathcal{D} \) where \( \mathcal{U} \) is a

Definition 0.41: A \( n \)-dimensional locally flat manifold is
assumption is not necessary. From this non-vanishing theorem, from this point of view the compacness
related to cohomological non-vanishing. The K-V cohomology supplies
according to the conjecture of Cerstenhaber; this non-rigidity would be
non-trivial deformations.

Theorem 0.43 A compact locally flat hyperbolic manifold always admits
deduced from the theorem above the following relevant consequence.
covariant derivative \( D \) is positive definite.

and only if it carries a de Rham-closed differential 1-form \( \omega \) whose
Theorem 0.42 A compact locally flat manifold (\( M \), \( \Omega \)) is hyperbolic if

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A morphism from $\Lambda$ to the tangent bundle $\mathcal{M}$ of $\Lambda$ is called an anchor. A vector bundle over a smooth manifold $\mathcal{M}$ and $\Lambda$ is a pair $(\mathcal{M}, \Lambda)$ where $\Lambda$ is a vector bundle.

Definition 0.44: An anchored vector bundle is a pair $(\mathcal{M}, \Lambda)$ where $\Lambda$ is a sections of vector bundles.

...sections of vector bundles... is that smooth functions on the parameters act on uncontrollable is that smooth sections of vector bundles. What make situations spaces by smooth sections of vector bundles. What make situations fields.

Algebra. From this viewpoint we may replace elements of vectors linear. Let us regard the theory of vector bundles as parametrized linear.

Anchored vector bundles, algebroids and foliations...
with anchored algebroids.

sections of an algebroid is a left \( M \)-module as well. We are concerned
smooth functions on the base manifold. The vector space of smooth

Let \( M \) be the real associative commutative algebra of real valued
smooth sections is endowed with a real algebra structure

Definition 0.45. An algebroid is a vector bundle whose vector space of
Relevant questions on anchored algebroids is to control the following:

\[ s(f(s)v) - (fs) - (sf)v = (fs, fs) \]

Leibniz anomaly and \( J \) of skew symmetric algebroids.

Anomalies arise the question gives rise the products on a product where \( s \) acts on a product of \( M \in f \). This question to know how does a section differential of \( M \in f \). Arises the question is the usual \( fp \) where \( ((s)v)fp = f(s)vf \). By \( s \) of \( s \), \( s \), of \( s \) is denoted by \( s \). In this situation every smooth section of \( s \), \( s \), of \( s \) be an anchored algebroid. The product two smooth sections
anomaly and Leibniz anomaly vanishing identically
Leibniz anomaly vanishing identically (respectively whose Koszul-Vinberg
algebroid) is an anchor algebroid whose both Jacobi anomaly and

Definition A.46: A Lie algebroid (respectively a Koszul-Vinberg

involutive differential system defining a foliation which may be singular.

does the anchor A induce is interesting. It so is the case, A
viewpoint and from geometrical viewpoint the question to know whether

Suppose (n, \Lambda, \sigma) to be a skew symmetric algebroid. From topological
Skew symmetric algebroids \rightarrow \text{Jacobi anomaly}

The base manifold...Aug.

From the Lie algebra of smooth to Lie algebra of smooth vector fields on anchor map of a Lie algebroid induces a Lie algebra homomorphism

Common... An interesting consequence of Definition above is that the...
bundle over $\mathcal{M}$ is canonically a left module of $\mathcal{M}$ along $\mathcal{H}$ (comment...).)

is endowed with the usual product of two real-valued functions. Every vector

with zero anchor map. The vector space of its smooth sections

K-Y-algebroid whose base manifold is $\mathcal{M}$ is the trivial vector bundle

to various types of algebroids. A particularly important example of

leads to control Jacobi anomaly and Leibniz anomaly. This leads

Many of them are interesting for mathematical physics. Really the

There is an impressive literature on generalizations of Lie algebroids.
We are going to overview some recent progress.

algebroids (JR Dutour] and for KV-algebroids [Boyom-WolaK].

is their normal forms. Nowadays this question is solved for Lie

From singular foliation viewpoint, a relevant question about algebroids

algebroids and of Courant algebroids (cf. MGB, submitted).

... al[9]...)

Lie algebroids and groupoids (cf. [[MNB]], anchored vect bun and

... al[9]...)

Relationship with foliations (cf. [[MNB]], anchored vect bun and

algebroids (cf. [[MNB]], anchored vect bun and al[9]...)

case of Courant algebroids what are particular case of CC
forms to control the anomalies of anchored algebroids. This is the

Asymmetric algebroids — KV-Algebroid One can use quadratic
Topology and geometry of algebroids

1. Normal forms of KY-algebroids and of Lie algebroids (ct [NBW, Bull Sc Math] [2006])

2. Courant algebroids and Dirac structures (ct [Lu-Wei-Xu, [Du-Wad] [2005])

Skew symmetric Courant algebroids (ct [Courant, Lu-Wei-Xu, Uehiro, MNB] [2006])

Asymmetric Courant algebroids and KY-algebroids (ct [MNB, NB-Wo] [2005])

1. Normal geometry of algebroids

Cohomology of K\-algebroids and Dirac reduction of Poisson

Jour......

Cohomology of K\-algebroids and Poisson manifolds (cf. Int. Math.

and related topics.

Asymptotic Courant algebroids. Extension problem. Module problem


Skew symmetric Courant algebroids. Extension problem (see

Algebrasic topology of algebroids
Lagrangian Invariants...

Some new field of investigations (NA report, Pairing problem, ...

MAIN THEOREM: Every Poisson manifold is Dirac reduction (ct Jim)