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of analysis»

Book of abstracts



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LIST OF TOPICS

- Algebraic methods in geometry
- Differential geometry in the large
- Geometry and topology of differentiable manifolds
- General and algebraic topology
- Dynamical systems and their applications
- Geometric problems in mathematical analysis
- Geometric and topological methods in natural sciences
- History and methodology of teaching in mathematics

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НТБ ОНАФТ

Dual modules over Steenrod algebra 2

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Article [3] studies structures of modules over Steenrod algebra A and their duals in dual Steenrod algebra A^* [2], [4]. [1] studies modules $A(n)$ over A generated by annihilators of cohomology classes with degrees no greater than n . $A(n)^+$ is defined as annihilators of cohomology operations with excess greater than n [6]. In A^* , $A(n)^*$ is the corresponding dual module of $A(n)$. $A(n)^+$ as vector space over Z_p is generated by all monomials of A^* with multiplicity no greater than n [5], [6].

This work studies structure of modules $B(n) = (A(n-1)/A(n))^*$. $B(n)$ as a Z_p vector space has a basis formed by all monomials with multiplicity n in dual Steenrod algebra A^* [6], and $B(n)$ can be considered both left and right over A^* .

The result is stated here:

Theorem 1 (Properties of quotient A^* -modules $(A(n-1)/A(n))^*$). 1) $B(n)$ is a graded Hopf comodule over Steenrod algebra A^* with comultiplication

$$\phi_n^* : B(n) \rightarrow A^* \otimes B(n), \quad \phi_n^*([\alpha]) = \sum_i \alpha'_i \otimes [\alpha'_i]$$

induced by comultiplication in comodule $A(n)^+$, with homomorphism property

$$\begin{aligned} \phi_n^*([\alpha] * [\beta]) &= \phi_n^*([\alpha\beta]) \\ &= (\psi^* \otimes \psi_n^*)(Id_{A^*} \otimes T \otimes Id_{B(n_2)})(\phi_{n_1}^*([\alpha]) \otimes \phi_{n_2}^*([\beta])) \\ &\stackrel{def}{=} \phi_{n_1}^*([\alpha]) * \phi_{n_2}^*([\beta]) \end{aligned}$$

where $\psi_{n_1+n_2}^* : B(n_1) \otimes B(n_2) \rightarrow B(n_1+n_2)$ is a multiplication defined by

$$\psi_{n_1+n_2}^*([\alpha] \otimes [\beta]) = [\psi^*(\alpha \otimes \beta)] = [\alpha\beta] = [\alpha] * [\beta]$$

induced by multiplication ψ^* in A^* , T is a transposition, $[\alpha]$ in $B(n_1)$, and $[\beta]$ in $B(n_2)$.

2) $B(n) = \bigoplus_s B(n)^s$ is the direct sum of Hopf comodules

$$B(n)^s = \text{Span}\{\tau_0^{s_0} \tau_1^{s_1} \tau_2^{s_2} \dots \xi_1^{r_1} \xi_2^{r_2} \xi_3^{r_3} \dots \in A^* \mid \sum_i s_i = s\}$$

3) $B(n)_t = \bigoplus_s B(n)_t^s$ is the direct sum of comodules $B(n)_t = (A(n)^+ \cap A_t^*) / (A(n-1)^+ \cap A_t^*)$ defined on the filtration of dual Steenrod algebra A^* by Hopf subalgebras

$$A_{-1}^* \subset A_0^* \subset A_1^* \subset \dots \subset A_n^* \subset A_{n+1}^* \subset \dots \subset A^*,$$

where $A_t^* = Z_p\{\xi_1, \xi_2, \dots\} \otimes E\{\tau_0, \tau_1, \dots, \tau_t\}$ and $A_{-1}^* = Z_p\{\xi_1, \xi_2, \dots\}$. The restrictions of the comultiplication and multiplication (1) on the filtration are well defined maps:

$$\phi_{n,t}^* : B(n)_t \rightarrow A^* \otimes B(n)_t, \quad \text{and} \quad \psi_{n_1 n_2, t}^* : B(n_1)_t \otimes B(n_2)_t \rightarrow B(n_1+n_2)_t.$$

4) Any $[\alpha]$ in $B(n)_t$ has unique form $[\alpha] = [\beta] + [\gamma] * [\tau_t]$ where $[\beta] \in B(n)_{t-1}$ and $[\gamma] \in B(n-1)_{t-1}$, and there are homomorphisms of comodules $i_{n,t}$ and $\pi_{n,t}$ such that $i_{n,t}([\beta]) = [\beta]$, and $\pi_{n,t}([\alpha]) = [\gamma]$, and the following diagram with exact rows commutes

$$\begin{array}{ccccccc} 0 & \longrightarrow & B(n)_{t-1} & \xrightarrow{i_{n,t}} & B(n)_t & \xrightarrow{\pi_{n,t}} & B(n-1)_{t-1} \longrightarrow 0 \\ & & \phi_{n,t-1}^* \downarrow & & \phi_{n,t}^* \downarrow & & \phi_{n-1,t-1}^* \downarrow \\ 0 & \longrightarrow & A^* \otimes B(n)_{t-1} & \xrightarrow{Id \otimes i_{n,t}} & A^* \otimes B(n)_t & \xrightarrow{Id \otimes \pi_{n,t}} & A^* \otimes B(n-1)_{t-1} \longrightarrow 0 \end{array}$$

REREFENCES

- [1] H. Cartan. Algebres d'Eilenberg-MacLane at Homotopie. *Seminare Cartan ENS*, 7e, 1954–1955.
- [2] J. Milnor. The Steenrod algebra and its dual. *Annals of Mathematics*, 67 : 150–171, 1958.
- [3] J. Milnor, J. Moore. On the structure of Hopf algebras. *Annals of Mathematics*, 81 : 211–264, 1965.
- [4] N. Steenrod, D. B. A. Epstein. *Cohomological Operations*, Princeton University Press, 1962.
- [5] А. Н. Васильченко. Свойства дуальных модулей над алгеброй Стиррода. Abstracts of the International Conference “Geometry in Odessa” – 2014, Odessa the 26th of May – the 31st of May 2014: p.26
- [6] А. Н. Васильченко. Свойство дуальных модулей над алгеброй Стиррода. *Вестник СамГУ* 7(118) : 9–16, 2014.

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