$2 \leqq j \leqq r$, $d_j = 0$ for $2 \leqq j \leqq r-1$, and the differential operator d_r is given by a cap product $d_r(h) = \gamma \cap h$, $h \in H(B, H(F))$, where γ is the characteristic cohomology class of B and $\pi_r(B)$ and $H(F)$ are suitably paired. In the above cited reference crucial use was made of continuous maps $\tilde{\lambda}: \tilde{B} \times F \to X$ ($\tilde{B}$ is the space of paths starting at the base point in B) and $\bar{\lambda}: X^I \to X^I$ induced by a lifting function λ for $\mathfrak{F}$. For Serre fiber spaces, lifting functions are no longer available and the extension of the above theorem requires the use of the Covering Homotopy Theorem to define, directly at the singular chain level, chain mappings analogous to those induced by the continuous maps $\tilde{\lambda}$ and $\bar{\lambda}$. (Received June 14, 1957.)

809*t*. R. H. Fox and J. W. Milnor: *Singularities of 2-spheres in 4-space and equivalence of knots.*

The boundary $\dot{\sigma}$ of a small 4-simplex σ around a point x of an oriented polyhedral surface F in oriented 4-space will intersect F in an oriented simple closed curve C. If C is knotted in the 3-sphere $\dot{\sigma}$ then x is a *singular point* and the knot type k of C is the *singularity* at x. Let k^{-1} denote the knot type obtained from k by reversing the orientation of C and taking its mirror image. Define k and l to be *equivalent* if there exists a polyhedral 2-sphere in 4-space having only two singular points, one of type k and one of type l^{-1}. Then the equivalence classes of knots form an abelian group G under the usual product operation. A collection $k_1, \cdots, k_n$ of knot types occurs as the collection of singularities of some 2-sphere iff the product $k_1 \cdots k_n$ is equivalent to the trivial knot. In order that k and l be equivalent it is necessary that the product of their Alexander polynomials have the form $a(t)a(1/t)$ for some integral polynomial $a(t)$. Consequently G is not finitely generated. G contains elements of order 2; it is conjectured that G also contains elements of order >2. (Received July 15, 1957.)

810. E. E. Grace: *The existence of cut sets in totally nonaposyndetic continua.*

Results of F. Burton Jones (Amer. J. Math. vol. 70 (1948) pp. 403–413) on the existence of weak cut points in certain nonaposyndetic compact metric continua are extended to a class of connected topological spaces which have a certain generalized completeness property. Stronger cutting properties are obtained and the use of an extension of the idea of nonaposyndesis yields weak cut sets in some cases where there are no cut points. (Received July 8, 1957.)

811*t*. Edward Halpern: *On the cohomology of certain loop spoces.*

Let J be a principal ideal domain. A *monogenic twisted polynomial J-algebra* of *binomial type* and *height h*, $(2 \leqq h \leqq \infty)$, is free J-module generated by a sequence of elements $x_0, x_1, \cdots, x_{h-1}$ and multiplication defined by $x_m x_n = (m, n) x_{m+n}$ for $m+n < h$, ((m, n) is the binomial coefficient $(m+n!)/(m!n!)$), and $x_m x_n = 0$ for $m+n \geqq h$; it is denoted by $J[x_1; h, (m, n)]$. Let X be a topological space with (singular) cohomology $H^*(X, J) = J[x]/(x^h)$, $2 \leqq h \leqq \infty$, with x of even degree d. Let Ω denote the space of loops at a base point of X. (a) If J has characteristic zero then $H^*(\Omega, J) \cong \bigwedge_J(z_1) \otimes J[z_2; \infty, (m, n)]$, where $z_1, z_2 \in H^*(\Omega, J)$ have degrees $d-1$ and $hd-2$ respectively. (b) If J has characteristic $p \neq 0$ then $H^*(\Omega, J) \cong \bigwedge_J(z_1) \otimes_{i \geqq 0} J[z_{2p^i}; p, (m, n)]$, where $z_1, z_{2p^i} \in H^*(\Omega, J)$ have degrees $d-1$ and $p^i(hd-2)$ respectively, ($\otimes_{i \geqq 0}$ denotes the "weak" tensor product). In particular, the theorem applies to complex and quaternionic projective n-spaces $(1 \leqq n \leqq \infty)$ and the Cayley plane. (Received June 7, 1957.)