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DEFORMATIONS AND THE RATIONAL HOMOTOPY OF THE MONOID OF FIBER HOMOTOPY EQUIVALENCES

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Suppose X is a topological space which has the homotopy type of a CW-complex. Then it is well known that Hurewicz fibrations $X \to E \to B$ are classified up to fiber homotopy equivalence by the homotopy classes of maps $f\colon B \to B\,\mathrm{aut}(X)$ where $\mathrm{aut}(X)$ denotes the topological monoid of self homotopy equivalences of X. It is then highly interesting to calculate certain elementary topological invariants of the classifying space $B\,\mathrm{aut}(X)$ in terms of the invariants of X.

Here we are in particular interested in the rational homotopy of $B\,\mathrm{aut}(X)$. A case which seems to be rather treatable is the case of the so called F_0-spaces.

DEFINITION. A 1-connected space X is said to be of type F_0 if the following conditions are satisfied.

(i) $\dim H^*(X;\mathbf{Q}) < \infty$
(ii) $\dim \pi_*(X) \otimes_{\mathbf{Z}} \mathbf{Q} < \infty$
(iii) $H^{\mathrm{od}}(X;\mathbf{Q}) = 0$.

Under these conditions S. Halperin [2] was able to show that the cohomology $A_0 = H^*(X)$ is a complete intersection, i.e., we have

$$A_0 = P/I_0,$$

where P is a graded polynomial algebra in n generators of even degree and I_0 is an ideal generated by a maximal length prime series $\{f_1, \dots, f_n\}$ of homogeneous elements.

It is exclusively this case which will concern us on the subsequent pages. In the papers [6, 7] W. Meier found formulas for the rational homotopy groups of $B\,\mathrm{aut}(X)$, see e.g., [6], Prop. 2.10 and [7], Prop. 1. In these expressions the evenly graded part $\pi_{\mathrm{ev}}(\mathrm{aut}(X)) \otimes_{\mathbf{Z}} \mathbf{Q}$ of the rational homotopy is interpreted as the negatively graded part of the A_0-module of graded $\mathbf{Q}$-derivations $\mathrm{Der}_{\mathbf{Q}} A_0$. It is a longstanding conjecture that in the case of a complete graded

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