

THE ARF–Kervaire INVARIANT OF FRAMED MANIFOLDS AS AN OBSTRUCTION TO EMBEDDABILITY

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ABSTRACT. We prove that no 14-connected (resp. 30-connected) stably parallelizable manifold N^{30} (resp. N^{62}) of dimension 30 (resp. 62) with the Arf–Kervaire invariant 1 can be smoothly embedded into $\mathbb{R}^{30}$ (resp. $\mathbb{R}^{63}$).

1. Closed stably parallelizable manifolds with a nontrivial Arf–Kervaire invariant

Let us consider a closed stably framed n –dimensional manifold. Such a manifold is presented by the pair (N^n, Ξ) , where N^n is a closed manifold of the dimension $\dim(N) = n$, and Ξ is an isomorphism of bundles $\Xi : \nu(N) = \mathbb{R}^k \times N^n$, where $\nu(N)$ is the k –dimensional normal bundle of N^n , $k > n + 1$. A stably parallelizable manifold is a stably framed manifold with the forgotten stable framing.

Suppose that $n = 2^\ell - 2 = 4l + 2$ and that N^n is $2l$ –connected. Then N^n is diffeomorphic to the connected sum of manifolds of the following three types (see Kreck (2000) for the proof and further references):

- closed manifold Σ^n , homotopically equivalent to the standard n –dimensional sphere;
- product of two standard spheres $S^{2l+1} \times S^{2l+1}$;
- standard Arf–Kervaire manifold (constructed later).

A connected sum of two third type manifolds is diffeomorphic to the standard sum of some number of first and second type manifolds. The dimension $\dim(H_{2l+1}(N^n; \mathbb{Z}/2))$ is always even and equals to $2p$, where p is the number of the summands of second and third type. Following the statement of the Hill, Hopkins and Ravenel Theorem, third type manifold can be constructed only for $\ell = 5, 6$ and eventually 7 (see Hill *et al.* 2016). The above statement was proved by Akhmetiev (2022, p. 3), except for possibly finite number of exceptional cases (there is an error in the proof of Proposition 2: the mapping of regular cobordism classes on p.34 is not a homomorphism).

Definition 1.1. A $2l$ –connected manifold N^n , $n = 4l + 2$, is said to have a nontrivial Arf–Kervaire invariant if $n = 2^\ell - 2$, $\ell = 5, 6$ or 7, and N^n is diffeomorphic to the connected sum of a third type manifold and some number of first and second type manifolds.

A Product Formula For Arf Kervaire Invariant

Bruce A. Magurn



A Product Formula For Arf Kervaire Invariant:

A Product Formula for Arf-Kervaire Invariant Edgar H. Brown, 1973* Stable Homotopy Around the Arf-Kervaire Invariant Victor P. Snaith, 2009-03-28

Were I to take an iron gun And re it o towards the sun I grant twould reach its mark at last But not till many years had passed But should that bullet change its force And to the planets take its course Twould never reach the nearest star Because it is so very far from FACTS by Lewis Carroll 55 Let me begin by describing the two purposes which prompted me to write this monograph This is a book about algebraic topology and more especially about homotopy theory Since the inception of algebraic topology 217 the study of homotopy classes of continuous maps between spheres has enjoyed a very exc n n tional central role As is well known for homotopy classes of maps $f: S^n \rightarrow S^n$ with $n \geq 1$ the sole homotopy invariant is the degree which characterises the homotopy class completely The search for a continuous map between spheres of different dimensions and not homotopic to the constant map had to wait for its resolution until the remarkable paper of Heinz Hopf 111 In retrospect nding 3 an example was rather easy because there is a canonical quotient map from S^3 to $S^1 \times S^2$ the orbitspace of the free circle action $S^1 \times S^3 \rightarrow S^1 \times S^2$ *Algebraic Topology, Aarhus 1978* J. L. Dupont, I. H. Madsen, 2006-11-15 University of Aarhus 50 Anniversary 11 September 1978 Number Theory in Progress Kálmán Györy, Henryk Iwaniec, Jerzy Urbanowicz, 2012-02-13 Proceedings of the International Conference on Number Theory organized by the Stefan Banach International Mathematical Center in Honor of the 60th Birthday of Andrzej Schinzel Zakopane Poland June 30 July 9 1997 **Surgery on Compact Manifolds** C. T. C. Wall, 2024-11-18

The publication of this book in 1970 marked the culmination of a particularly exciting period in the history of the topology of manifolds The world of high dimensional manifolds had been opened up to the classification methods of algebraic topology by Thom's work in 1952 on transversality and cobordism the signature theorem of Hirzebruch in 1954 and by the discovery of exotic spheres by Milnor in 1956 In the 1960s there had been an explosive growth of interest in the surgery method of understanding the homotopy types of manifolds initially in the differentiable category including results such as the h cobordism theory of Smale 1960 the classification of exotic spheres by Kervaire and Milnor 1962 Browder's converse to the Hirzebruch signature theorem for the existence of a manifold in a simply connected homotopy type 1962 the s cobordism theorem of Barden Mazur and Stallings 1964 Novikov's proof of the topological invariance of the rational Pontrjagin classes of differentiable manifolds 1965 the fibering theorems of Browder and Levine 1966 and Farrell 1967 Sullivan's exact sequence for the set of manifold structures within a simply connected homotopy type 1966 Casson and Sullivan's disproof of the Hauptvermutung for piecewise linear manifolds 1967 Wall's classification of homotopy tori 1969 and Kirby and Siebenmann's classification theory of topological manifolds 1970 The original edition of the book fulfilled five purposes by providing a coherent framework for relating the homotopy theory of manifolds to the algebraic theory of quadratic forms unifying many of the previous results a surgery obstruction theory for manifolds with arbitrary fundamental group including the exact sequence for the set of

manifold structures within a homotopy type and many computations the extension of surgery theory from the differentiable and piecewise linear categories to the topological category a survey of most of the activity in surgery up to 1970 a setting for the subsequent development and applications of the surgery classification of manifolds This new edition of this classic book is supplemented by notes on subsequent developments References have been updated and numerous commentaries have been added The volume remains the single most important book on surgery theory *Bulletin of the American Mathematical Society* American Mathematical Society,1975 Surgery Theory Wolfgang Lück,Tibor Macko,2024-07-05 This monograph provides a comprehensive introduction to surgery theory the main tool in the classification of manifolds Surgery theory was developed to carry out the so called Surgery Program a basic strategy to decide whether two closed manifolds are homeomorphic or diffeomorphic This book provides a detailed explanation of all the ingredients necessary for carrying out the surgery program as well as an in depth discussion of the obstructions that arise The components include the surgery step the surgery obstruction groups surgery obstructions and the surgery exact sequence This machinery is applied to homotopy spheres the classification of certain fake spaces and topological rigidity The book also offers a detailed description of Ranicki's chain complex version complete with a proof of its equivalence to the classical approach developed by Browder Novikov Sullivan and Wall This book has been written for learning surgery theory and includes numerous exercises With full proofs and detailed explanations it also provides an invaluable reference for working mathematicians Each chapter has been designed to be largely self contained and includes a guide to help readers navigate the material making the book highly suitable for lecture courses seminars and reading courses Reviews in K-theory, 1940-84 Bruce A. Magurn,1985 **Symposium on Algebraic Topology in Honor of Jose Adem** Samuel Gitler,1982 Alerta ,1975

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