

CONTENTS

Introduction	vi
1. The homotopy category of $(2, 4)$-complexes	1
1.1. Quadratic functions and the Hopf map	1
1.2. Simply connected 4-manifolds and $(2, 4)$ -complexes	7
1.3. The homotopy category of $(2, 4)$ -complexes	12
2. The homotopy category of simply connected 4-manifolds	18
2.1. The homotopy category of $(2, 4)$ -Poincaré complexes	18
2.2. Maps of non-trivial degree	22
2.3. The double suspension	31
2.4. The odd part and the signature obstruction	35
2.5. The group of homotopy equivalences	43
2.6. The Lie part	44
2.7. The homotopy category of maps with non-trivial degree	48
3. Track categories	55
3.1. The track category of one point unions of n -spheres	55
3.2. The linear extension $T(2, 4)$ defined by tracks	58
3.3. The linear extensions $\mathbf{T}\Gamma$ and \mathbf{TL}	61
4. The splitting of the linear extension \mathbf{TL}	63
4.1. The quadratic refinement $\hat{\Gamma}$ and an algebraic model of the track category \mathbf{TL}	63
4.2. Extension of functors	69
4.3. The extension class $\langle \mathcal{L} \rangle$	72
4.4. Computation of Ext-groups	74
4.5. The splitting of \mathbf{TL} and a model of $\mathbf{CW}(2, 4)/D_\Gamma$	85
5. The category $\mathbf{T}\Gamma$ and an algebraic model of $\mathbf{CW}(2, 4)$	89

5.1. The quadratic refinement $\bar{\Gamma}$	89
5.2. Algebraic models of the categories $\mathbf{T}(2, 4)$ and $\mathbf{CW}(2, 4)$	101
6. Crossed chain complexes and algebraic models of tracks	105
6.1. The quadratic refinement $\bar{\Gamma}$	105
6.2. The crossed James construction of a group	110
6.3. The isomorphism $\tilde{J}G = \tilde{\Gamma}G$ for a free group G	115
6.4. The crossed 3-type of a loop space	121
7. Quadratic chain complexes and algebraic models of tracks ..	129
7.1. Square groups and the functor $\tilde{\Gamma}$	129
7.2. Crossed square groups	140
7.3. The quadratic chain complex of the James construction	144
7.4. The quadratic James construction of a free group	149
7.5. The isomorphism $\tilde{J}G = \tilde{\Gamma}(G, \theta_0)$ for a free group G	156
7.6. The 3-type of the loop space of a one point union of 2-spheres ..	164
7.7. Algebraic models of tracks in $\mathbf{T}(2, 4)$	166
8. On the cohomology of the category $\text{nil.}(\mathbf{T})$ (T. Pirashvili)	170
8.1. Introduction	170
8.2. General facts	171
8.3. L_*F_1 and simplicial derived functors	172
8.4. Proof of the theorem	174
8.5. Calculations of $\text{Ext}_{\mathcal{F}}^*$	175
References	179
Index	182