

1. Introduction	1
1.1. Notes for the reader	7
1.2. Acknowledgements	7
2. Technical Preliminaries and Basic Notations	8
2.1. Γ -sets and isotropy types	8
2.2. Representations	8
2.3. Isotropy types for representations	10
2.4. Polynomial Invariants and Equivariants	10
2.5. Smooth families of equivariant maps	11
2.6. Normalized families	11
3. Branching and invariant group orbits	13
3.1. Relative equilibria and normal hyperbolicity	13
3.2. Branches of relative equilibria	17
3.3. The branching pattern	18
3.4. Stabilities	19
3.5. Branching conditions	19
3.6. The signed indexed branching pattern	20
3.7. Stable families	20
3.8. Determinacy	21
3.9. Strong determinacy	22
4. Genericity theorems	25
4.1. Semi-algebraic and semi-analytic sets	25
4.2. Invariant and equivariant generators	26
4.3. The variety Σ	26
4.4. Stability theorems I: Weak regularity	30
4.5. Stability theorems II: Regular families	34
4.6. Determinacy	41
4.7. Examples related to finite reflection groups	45
5. Finitely determined bifurcation problems I	47
5.1. The phase vector field	47
5.2. The spaces $\mathcal{A}_h(\Gamma, V)$, $\mathcal{B}_h(\Gamma, V)$	49
5.3. Strong determinacy	54
6. Finitely-determined bifurcation problems II	56
6.1. Statement of the main theorem	56
6.2. 2-stable relative equilibria	56
7. Strong determinacy: Technical preliminaries	62
7.1. Introduction	62
7.2. Notational conventions	62
7.3. Local geometry	63
7.4. Weakly regular families	65
7.5. Analytic families and solution branches	67
7.6. Compatible parametrizations and initial exponents	68
7.7. Remarks on the set $\mathcal{E}(f)$	70
7.8. The parametrization theorem	70

7.9. The space $\mathcal{R}^2$	72
7.10. Initial exponents and the space $\mathcal{R}^3$	72
8. Strong determinacy: Γ finite	74
8.1. Analytic parametrizations	74
8.2. Estimates on eigenvalues	78
8.3. Fractional power series	79
8.4. Eigenvalue estimates: Analytic case	83
8.5. Eigenvalue estimates: Smooth case	84
8.6. Proof of Theorem 8.2.6	86
8.7. Strong determinacy: Γ finite	87
8.8. Formation of new branches under perturbation	88
9. Strong determinacy: Γ compact, non-finite	89
9.1. Polar blowing-up: Local theory	89
9.2. Polar blowing-up: Global theory	91
9.3. Polar blowing-up a Γ -manifold	91
9.4. Blowing-up	94
9.4.1. Blowing-up along a linear subspace	
9.4.2. Blowing-up analytic varieties	
9.4.3. Blowing-up algebraic varieties	
9.5. Conical sets	97
9.6. Algebraic and analytic structure of the orbit strata	97
9.7. Blowing-up representations	99
9.7.1. Analytic theory	
9.7.2. Algebraic theory	
9.8. A tangent and normal decomposition	101
9.9. Blowing-up arcs	103
9.10. Analytic parametrizations of solution branches	105
9.11. Lifting analytic parametrizations	106
9.12. Controlling the lifts of analytic parametrizations	107
9.13. Symmetric structure of parametrizations	107
9.14. An alternative proof of Proposition 9.13.2	109
9.15. Extensions of Proposition 9.13.2	111
9.16. Review and Summary of Notations	112
9.17. The exponent $i_{\tilde{\Delta}}(\)$	113
9.18. Estimates on eigenvalues	114
10. Proofs of the parametrization theorems	117
10.1. Resolution of singularities	117
10.2. Blowing-up	118
10.3. Singular sets of real algebraic varieties	119
10.4. Embedded resolution of singularities	119
10.5. Blowing-up embeddings	121
10.6. Blowing up Σ	121
10.7. Reduction to a subspace of $\mathcal{V}_{\omega}(\Gamma, V)_N$	125
10.8. Families of subspaces of $\mathcal{V}_{\omega}(\Gamma, V)_{NR}$	127
10.9. Blowing-up the maps G^q	128
10.10. Proof of Theorem 7.8.5	131

11. An application to the equivariant Hopf bifurcation	135
11.1. Limit cycles for equivariant flows	135
11.2. The equivariant Hopf bifurcation & Fiedler's theorem	136
11.3. The equivariant Hopf bifurcation for $\Gamma \times S^1$ -equivariant families	136
11.4. Completion of the proof of Theorem 11.2.1	138
A. Branches of relative equilibria	139
A.1. Introduction	139
A.2. Background on normal hyperbolicity	140
A.3. Branches of relative equilibria I	142
A.4. Horn neighborhoods I	143
A.5. Statement of the main Theorem	145
A.6. Lipschitz maps	146
A.7. Norm equivalences	146
A.8. Diffeomorphisms	147
A.9. Coordinates near α	148
A.10. Lipschitz sections of E	150
A.11. The graph transform	151
A.11.1. The map f in ρ_p -coordinates	
A.11.2. Invertibility of g	
A.11.3. Contractivity of $f_\#$	
A.11.4. Perturbation theory	
A.12. Horn neighborhoods II	155
A.13. Vector space theory: Norm estimates in terms of eigenvalues	157
A.13.1. Hyperbolic linear maps	
A.13.2. Relatively hyperbolic families	
A.14. Conditions (U) and (V)	162
A.15. Branches of relative equilibria II	163
A.15.1. Standing assumptions	
A.16. Proof of Theorem A.5.1	165
References	168