TRANSFERS, UMKEHR MAPS AND RIEMANN-ROCH TYPE THEOREMS (WS15/16, FR 10-12, M 101)

ALEXANDER ENGEL AND GEORGIOS RAPTIS

Seminar schedule

Talk 1 (Georgios Raptis): *Introduction.* (16.10.2015)

Basic Theory of Transfer Maps.

Talk 2 (John Lind): *Introduction to parametrized stable homotopy theory.* Introduce the categories of parametrized spaces and spectra. Discuss base change functors and fiberwise duality.
References: [16].

Talk 3 (Oriol Raventós): *Transfer maps.* Explain the definition and the basic properties of parametrized transfer maps. Discuss the axiomatic characterization of transfer maps.
References: [16, Chapter 15], [6], [1, Chapter 4], [7].

Talk 4 (Thomas Fiore): *Transfer maps for bundles and Umkehr maps.* Discuss the geometric definition of transfer maps for smooth bundles. Define (twisted) Umkehr maps and explain the connection with transfer maps.
References: [5], [6], [10].

Talk 5 (Justin Noel): *The ∞-categorical approach.* (In this talk, the basic theory of ∞-categories will be assumed.) Present the constructions of parametrized transfer and Umkehr maps using the ∞-categorical approach to parametrized homotopy theory. Discuss the parametrized Atiyah duality theorem.
References: [2], [16].

Some Applications.

Talk 6 (Christoph Schrade): *The Adams conjecture.* Explain the significance of the Adams conjecture and discuss the proof via transfer maps due to Becker and Gottlieb.
References: [5], [1].

Talk 7 (Christian Dahlhausen) : *Other applications.* Discuss other applications of transfer maps in homotopy theory. Some examples are: [6, Theorem 1.1] and its corollaries, the Kahn-Priddy theorem [14] (also [1]), and many more (see [1], [9], [15, 3.2], etc.)

Bivariant Theories and Riemann-Roch type theorems.

Talk 8 (Hoang Kim Nguyen): *Bivariant theories and Grothendieck transformations.* Introduce the axiomatic framework of bivariant theories and the notion of a Grothendieck transformation.
References: [13, Chapters 1-2].

Talk 9 (Florian Strunk): *Cohomology theories as bivariant theories.* Explain the construction of a bivariant theory associated to a generalized cohomology theory.
References: [13, Chapter 3].

Talks 10-11 (Georg Tamme - Alexander Engel): *The differential Riemann-Roch theorem.* Discuss the differential Riemann-Roch theorem due to Atiyah and Hirzebruch and explain the connection with the Grothendieck-Riemann-Roch theorem.
References: [13, Chapter 4], [3], [4].

Bivariant A-theory and the A-theory Euler class.

Talk 12 (John Lind): *Bivariant A-theory and coassembly maps.* Recall the definition of Waldhausen K-theory and explain the definition and the properties of bivariant algebraic K-theory of spaces. Define assembly and coassembly maps.
References: [18], [17].

Talk 13 (Georgios Raptis): *The Dwyer-Weiss-Williams theorems.* Define the A-theory Euler characteristic and explain its properties. Discuss the Riemann-Roch theorem of Dwyer-Weiss-Williams in the smooth case using the bivariant formalism.
References: [12], [18], [11], [17].

Differential K-theory.

Talk 14 (Ulrich Bunke): *Introduction to differential cohomology and differential algebraic K-theory.* A quick summary of the basic definitions and properties.
References: [8].

Talk 15 (Ulrich Bunke): *Transfers in differential cohomology and the transfer index conjecture.* Explain the definition of the transfer map in differential cohomology and in differential algebraic K-theory. State the transfer index conjecture and discuss the connections with the Dwyer-Weiss-Williams theorem.
References: [8].

References

[1] Adams, John Frank, *Infinite loop spaces.* Annals of Mathematics Studies, 90. Princeton University Press, Princeton, N.J.; University of Tokyo Press, Tokyo, 1978.
[2] Ando, Matthew; Blumberg, Andrew J.; Gepner, David, *Parametrized spectra, multiplicative Thom spectra, and the twisted Umkehr map*, arXiv.

[3] Atiyah, M. F.; Hirzebruch, F. *The Riemann-Roch theorem for analytic embeddings,* Topology 1 (1962), 151-166.
[4] Atiyah, M. F.; Hirzebruch, F. *Riemann-Roch theorems for differentiable manifolds,* Bull. Amer. Math. Soc. 65 (1959), 276-281.
[5] Becker, J. C.; Gottlieb, D. H., *The transfer map and fiber bundles,* Topology 14 (1975), 1-12.
[6] Becker, J. C.; Gottlieb, D. H., *Transfer maps for fibrations and duality,* Compositio Math. 33 (1976), no. 2, 107-133.
[7] Becker, James C.; Schultz, Reinhard E., *Axioms for bundle transfers and traces,* Math. Z. 227 (1998), no. 4, 583-605.
[8] Bunke, Ulrich; Gepner, David, *Differential function spectra, the differential Becker-Gottlieb transfer, and applications to differential algebraic K-theory*, arXiv.
[9] Clapp, Mónica, *Duality and transfer for parametrized spectra,* Arch. Math. (Basel) 37 (1981), no. 5, 462-472.
[10] Cohen, Ralph L.; Klein, John R., *Umkehr maps,* Homology, Homotopy Appl. 11 (2009), no. 1, 17-33.
[11] Dorabiała, Wojciech, *The double coset theorem formula for algebraic K-theory of spaces,* K-Theory 25 (2002), no. 3, 251-276.
[12] Dwyer, W.; Weiss, M., Williams, B., *A parametrized index theorem for the algebraic K-theory Euler class,* Acta Math. 190 (2003), no. 1, 1-104.
[13] Fulton, William; MacPherson, Robert, *Categorical framework for the study of singular spaces.* Mem. Amer. Math. Soc. 31 (1981), no. 243.
[14] Kahn, Daniel S.; Priddy, Stewart B., *Applications of the transfer to stable homotopy theory,* Bull. Amer. Math. Soc. 78 (1972), 981-987.
[15] Lemaire, J.-M., *Le transfert dans les espaces fibrés,* Séminaire Bourbaki, Vol. 1975/76, Exp. No. 472, pp. 23-37. Lecture Notes in Math., Vol. 567, Springer, Berlin, 1977.
[16] May, J. P.; Sigurdsson, J., *Parametrized homotopy theory.* Mathematical Surveys and Monographs, 132. American Mathematical Society, Providence, RI, 2006.
[17] Raptis, George; Steimle, Wolfgang, *On the map of Bökstedt-Madsen from the cobordism category to A-theory,* Algebr. Geom. Topol. 14 (2014), no. 1, 299-347.
[18] Williams, Bruce, *Bivariant Riemann Roch theorems,* Geometry and topology: Aarhus (1998), pp. 377-393, Contemp. Math., 258, Amer. Math. Soc., Providence, RI, 2000.