Homotopy Theory (L24)

Dr. R. Stoll

This will be an advanced course in Algebraic Topology, first describing higher homotopy groups and their associated theory and then introducing two of the most important computational tools in this subject: spectral sequences and cohomology operations. After developing the basic theory we will focus on calculations and applications of these tools.

Topics that might be covered are:

1. Higher homotopy groups; CW complexes and Whitehead's theorem; the Hurewicz theorem; fibre bundles and fibrations; Eilenberg–MacLane spaces; Postnikov systems.
2. The spectral sequence of a filtered space; the Serre spectral sequence; example calculations; applications to computing homotopy groups.
3. Steenrod squares and the Steenrod algebra; example calculations; applications to Stiefel–Whitney classes and vector fields on spheres.

Prerequisites

Part III Algebraic Topology.

Literature

1. O. Randal-Williams. *Homotopy Theory.* Lecture Notes.
   https://www.dpmms.cam.ac.uk/~or257/teaching/notes/HomotopyTheory.pdf
2. A. Hatcher. *Algebraic Topology.* Cambridge University Press, 2002.
   http://pi.math.cornell.edu/~hatcher/AT/AT.pdf

   As well as the online-only Chapter 5 available at
   http://pi.math.cornell.edu/~hatcher/AT/ATch5.pdf
3. R. E. Mosher and M. C. Tangora. *Cohomology operations and applications in homotopy theory.* Dover, 1968.

Additional support

Four examples sheets will be provided and four associated examples classes will be given. There will be a one-hour revision class in the Easter Term.