SEMINAR: INTRODUCTION TO SURGERY

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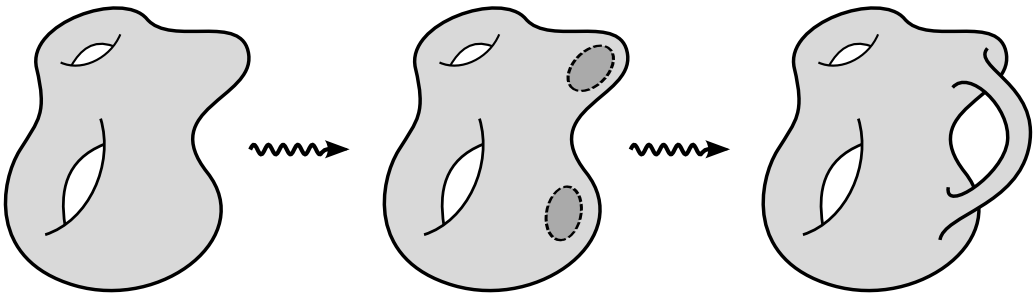
Surgery is a method to modify (smooth) manifolds without loosing the manifold structure. It can be used to alter the homotopy and homology groups in order to get rid off unwanted complexities. As such it is an important tool in the study of manifolds.

A simple, low-dimensional example for surgery is depicted in the graphic below.



The framework of surgery theory was developed by John Milnor around 1960, growing out of his Fields medal winning work on exotic spheres. The main purpose of surgery theory is to answer the question whether a given topological space is homotopy equivalent to a smooth manifold, and how many different differentiable structures it can have.

Seminar content

The seminar will be divided into two parts. For both parts we will follow the outline given in [Lue], chapter 1, respectively chapters 3/4/5.

The goal of the **first part** is to prove the h-cobordism theorem. Topics include: basic results in differential topology, Morse theory, handle decomposition of bordisms, handle cancellation, the algebraic K_1-group.

In the more advanced **second part** we work towards the surgery exact sequence. Topics include: the Pontrjagin-Thom construction, the Spivak normal fibration, normal maps, the intersection pairing, L-groups.

Prerequisites

- **Target audience**: master students; but ambitious bachelor students and PhD students are also very welcome
- **Part 1 requires** manifold basics (charts, partition of unity, ...), cellular homology
- **Part 2 requires** algebraic topology, parts I and II

How to participate

- **Where/When**: In HS4 on Thursdays at 14:15
- **First meeting** with introduction, assignment of talks is on 16.4.
- **More information** can be found on StudIP
- **Contact** me at martin-nitsche@t-online.de if you have any questions

References

[Lue] Wolfgang Lueck. A basic introduction to surgery theory. `http://131.220.77.52/lueck/data/ictp.pdf`.