



Seminar Advanced Differential Geometry

Morse Theory

Summer term 2022

Tuesday 13:15 – 14:45, Augusteum A-314 ; , Start: Tuesday, April, 5

Please enrol in [Moodle](#)**students:**

- mathematics (diploma)
- mathematical physics (M.Sc.), it is a compulsory elective course in the mathematical physics program (10-MAT-MPDG1). formed by the lecture and the seminar

Topics:

Morse theory describes the relationship between invariants of smooth functions on differentiable manifolds and their topology.

References:[M] J. Milnor: *Morse Theory*, Princeton University Press 1973

And for the last talk:

[H] M.W.Hirsch: *Differential topology*, Graduate texts in mathematics 33, 5th printing, 1994**List of talks:**

1. Morse lemma; [M] §2, p. 4 - 11
2. Topology of sublevels and critical points; [M] §3, p. 12 - 24
3. Examples and Morse inequalities; [M] §4, §5, p. 25 - 31
4. Existence of a Morse function; [M] §6, p. 32 - 38
5. The energy functional as a Morse function [M] §11, 12, 13, 14; p. 67 - 76
6. Jacobi fields and Morse' index theorem; [M] §14, 15, p. 77 - 87

7. Finite-dimensional approximation of the loop space, fundamental theorem of Morse theory and the loop space of spheres; [M] §16, §17 §19 p. 88 - 99
8. Symmetric spaces and Lie groups; [M] §20, §21, p. 109 - 117
9. Critical submanifolds; [M] §22, p. 118 -123
10. Bott periodicity for unitary groups; [M] §23, p. 124 - 132
11. Bott Bott periodicity for the orthogonal group; [M] §24, p. 133 - 148
12. Classification of surfaces with Morse theory; [H] chapter 9, p. 188 - 208