

Morse Theory

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Detailed plan

1. **Overview, Definitions, Morse-Lemma** ([Mi, Chapter 1, §2, pp. 4-11].)
2. **Homotopy type and critical values** ([Mi, Chapter 1, §3, pp. 12-24]).
3. **Examples, Morse inequalities, existence of Morse functions I** ([Mi, Chapter 1, §4-6, pp. 25-38])
4. **Examples, Morse inequalities, existence of Morse functions II** ([Mi, Chapter 1, §4-6, pp. 25-38])
5. **Riemannian geometry I** ([Mi, Chapter 1, §8, pp. 43-54])
6. **Riemannian geometry II** ([Mi, Chapter 1, §8, pp. 55-66])
7. **Hessian of the energy and Morse index on the path space** ([Mi, Chapter 3 §13 and §15])
8. **Finite dimensional approximation and the topology of the path space**([Mi, Chapter 3, §16-17])
9. **Topology and curvature** ([Mi, Chapter 3, §18-19, pp. 98-108])
10. **Symmetric spaces and Lie groups** ([Mi, Chapter 4, §20-22, pp. 109-123])
11. **Bott periodicity for the unitary group**([Mi, Chapter 4, §23, pp. 124-132])

The topics for the last few talks of the seminar will be determined later based on the interests of the participants. Possible topics include: Morse homology, Arnold conjecture, a short exposition to the h-cobordism theorem or Morse theory and handlebody decompositions.

References

- [Mi] J. Milnor, *Morse Theory*, Cambridge University Press, 1963
- [AD] M. Audin, M. Damian, *Morse theory and Floer homology*