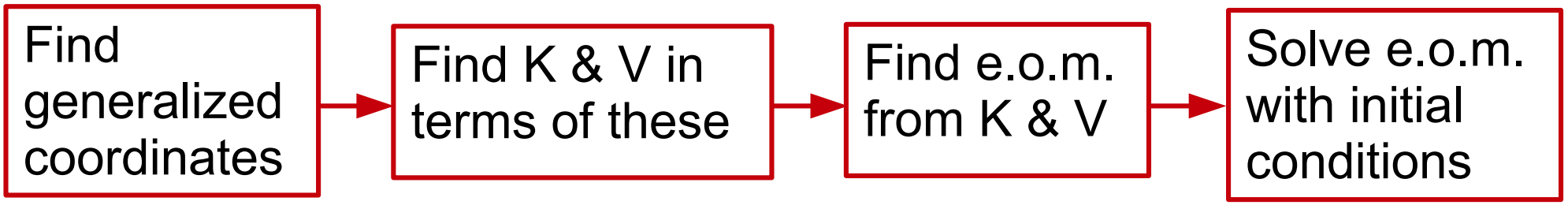
UiO : Fysisk institutt
Det matematisk-naturvitenskapelige fakultet

Lecture 2

Recap

- The essence of Lagrange-Hamilton formalism is



- A 3D system with N particles and M rigid (holonomic) constraints has d = 3N-M d.o.f.
- For each d.o.f. we choose a generalized coordinate q_i, i = 1,2,…,d.
- K & V can then be expressed as functions of q and qdot (“velocity” of q).

Plan for today

- Configuration space
  - The mathematical/geometrical properties of the generalized coordinates
- Virtual displacements
  - Start of proof of how to find e.o.m. from Lagrangian
  - Infinitesimals in the generalized coordinates
  - Constraint forces
- Static equilibrium
  - Reformulation in terms of potential energy

Configuration space

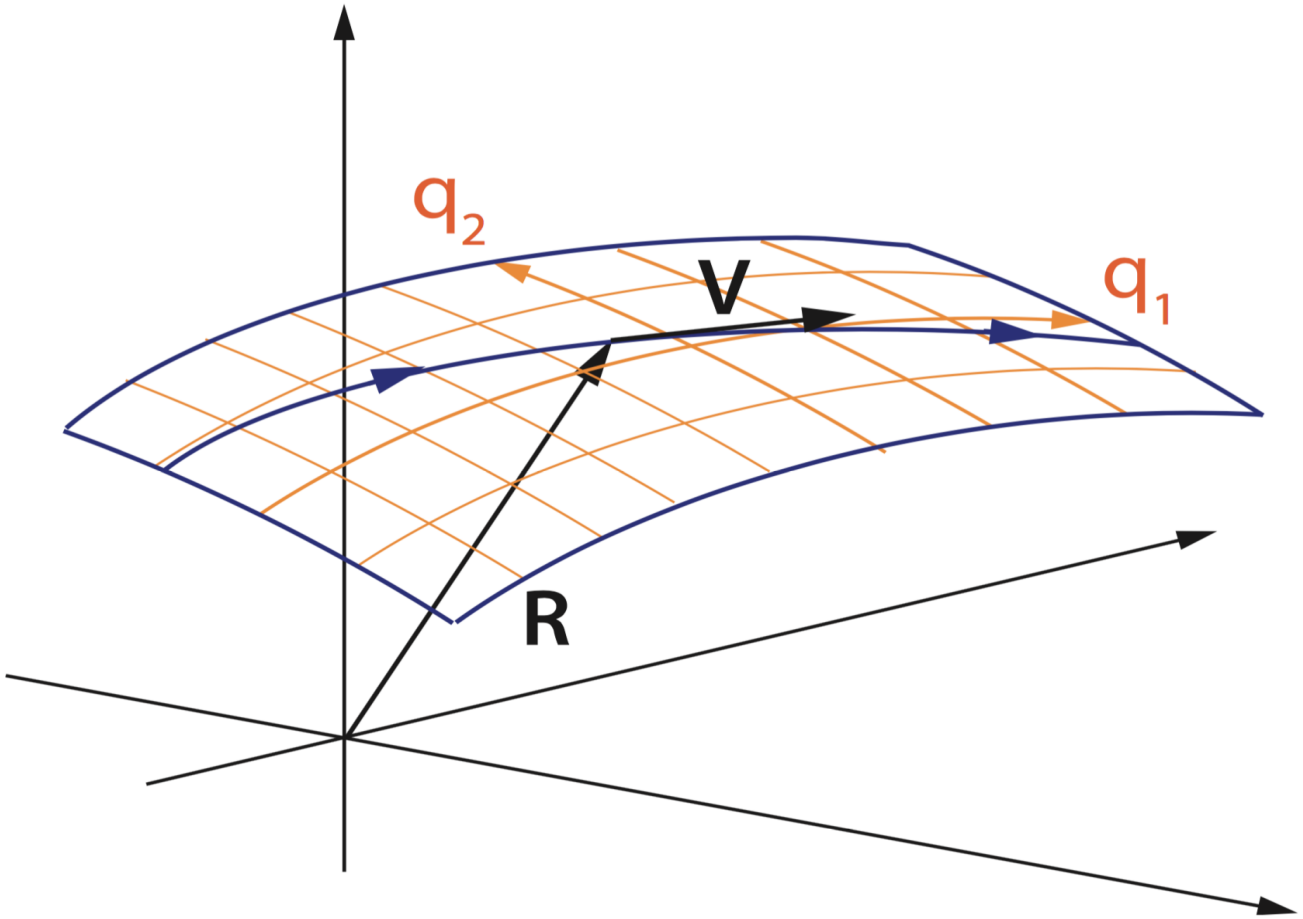


Illustration of configuration space with N=1, M=1, and d=3N-M=2.

Summary

- The set of generalized coordinates q_i is a d-dimensional manifold.
- The virtual displacement is the displacement of the original coordinates r_j by a change in the generalized coordinates q_i at fixed time.
- Constraint forces are the forces resulting from applied forces and the enforced constraints.
- Static equilibrium can be reformulated as as extremal point in the potential energy expressed in generalized coordinates.