



## Optimal Control Project: Ski Jumping

- 1) Carefully read the paper. Try to capture the main ideas.
- 2) Consider how you are going to present the solution via the PMP contained in the paper to your colleagues.
- 3) Solve the problem using the so called direct solution approach using Matlab.  
*Remark:* The main idea of the direct solution approach is to divide the time horizon in small pieces and parameterize the input signal in these intervals finitely. This leads to a finite dimensional optimization problem.  
The key problem in the ski jumper problem is that the flight time is not known a priori, since it depends on the flight trajectory.
  - Outline methods how you could tackle the problem with a direct solution method considering the unknown flight time.
  - For a first numerical solution fix the discretization interval length and use a longer flight time then necessary. Optimize the final flight distance, which is given by the intersection of the flight trajectory with the ground surface.
  - In a second solution approach consider the flight time also as optimization variable. Enforce that at the end of the flight time the flight trajectory intersects the ground surface. Note that the discretization interval length is given by  $\delta = T_F/N$ , where  $\delta$  is the discretization interval length,  $T_F$  is the flight time, and  $N$  is the number of discretization intervals.
- 4) Compare the obtained solutions. Discuss the encountered difficulties and the advantages of the different methods, including the solution via the PMP.