# Problem Formulation

Estimating the leader’s behavior: how to model it stochastically?

Consider active damping for payload oscillations.

Plan optimal trajectory for leader (or payload); what will the follower do?

Consider potential field for collision avoidance.

Consider optimal trajectory planning for n-robot swarm and assumptions about follower behaviors.

Followers: estimate the leader’s position and track that, not necessarily the instantaneous cable angle.

What has (not) been done? *Agent configuration, load configuration, measurements, trajectory planning (times, optimized / fixed), agent control strategy.*

Can you plan trajectory to minimize the whole system’s expended energy, anticipating each agent’s behaviors?

Can the agents have a locally optimal control law that gives globally desired behavior?

Should trajectory planning and control be separate problems?

Is MPC / LQR / sliding mode control the best available technique? Are there pitfalls for any? Can we do better?

# Theory

Review rotation matrices, kinematics and dynamics equations.

Study twists and wrenches.

~~Do the Kelly tutorial on direct collocation methods.~~

Study dynamic movement primitives.

Review SO(3), SE(3).

Study Udwadia-Kalaba method for dynamics formulation.

Study LQR.

# Project Management

Investigate Eric’s suggested software package and recommended textbook references.

**~~Inception report~~**~~: check requirements on webpage.~~

~~Do citations analysis on first round of papers; workflow:~~ **~~find, read, notes + read next, citations analysis.~~**

~~Finish notes for existing papers; digitize notes and next steps; check out optimal controllers; make new reading list.~~

~~Look for optimal control and CPT in literature survey.~~

Seek papers on optimal control for CPT in IROS 2018.

~~Annotated bibliography format: IEEE reference. Task. Grasped/cable-suspended? Centralized/distributed/decentralized? Control strategy (optimization, cost function structure?).~~

~~Create progress bulletin site in markdown.~~

~~Digitize minutes and outstanding tasks.~~

~~Digitize surveyed surveys notes.~~

Read and make notes for Dai et al. (2014) – in high-priority folder.

~~Make a feature grid for each paper to spot implementation patterns.~~

Read the ETH thesis.