

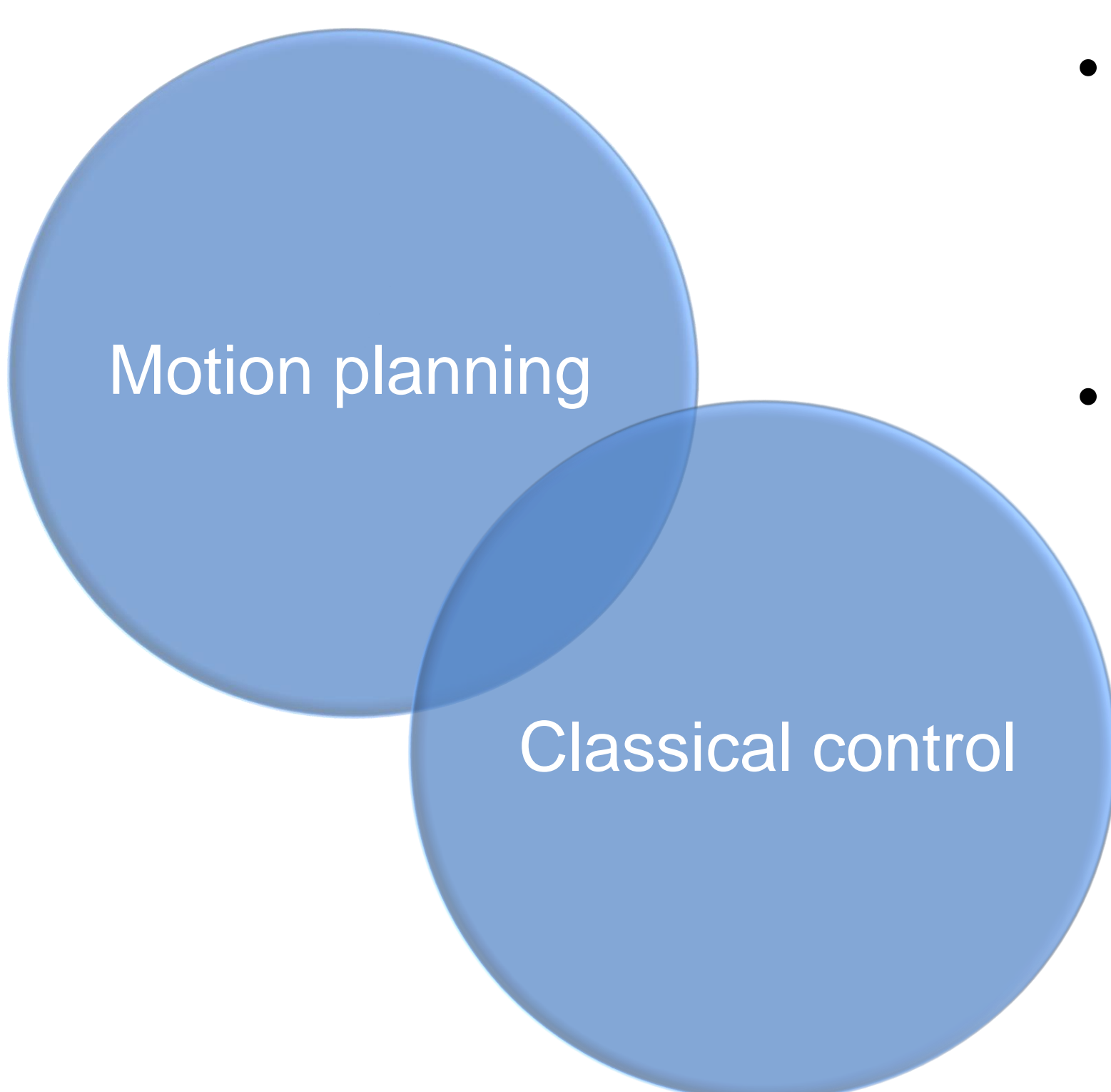
Stability and Controller Structure for Self-driving Vehicles

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Description:

The objective with the proposed research is to develop control strategies for which it is possible to a priori verify closed loop stability for self-driving vehicles. Our aim is to consider the two lowest levels of control; local planning and path following. The closed-loop system is an example of cascade control composed by a local planner and a path following controller. Typical tasks for the local planner are to handle overtakings and evasive maneuvers. Given a nominal path from the planning level, typical tasks that remain at the path following level are to reject "classical" disturbances such as friction errors, wind and load.

Background & Motivation



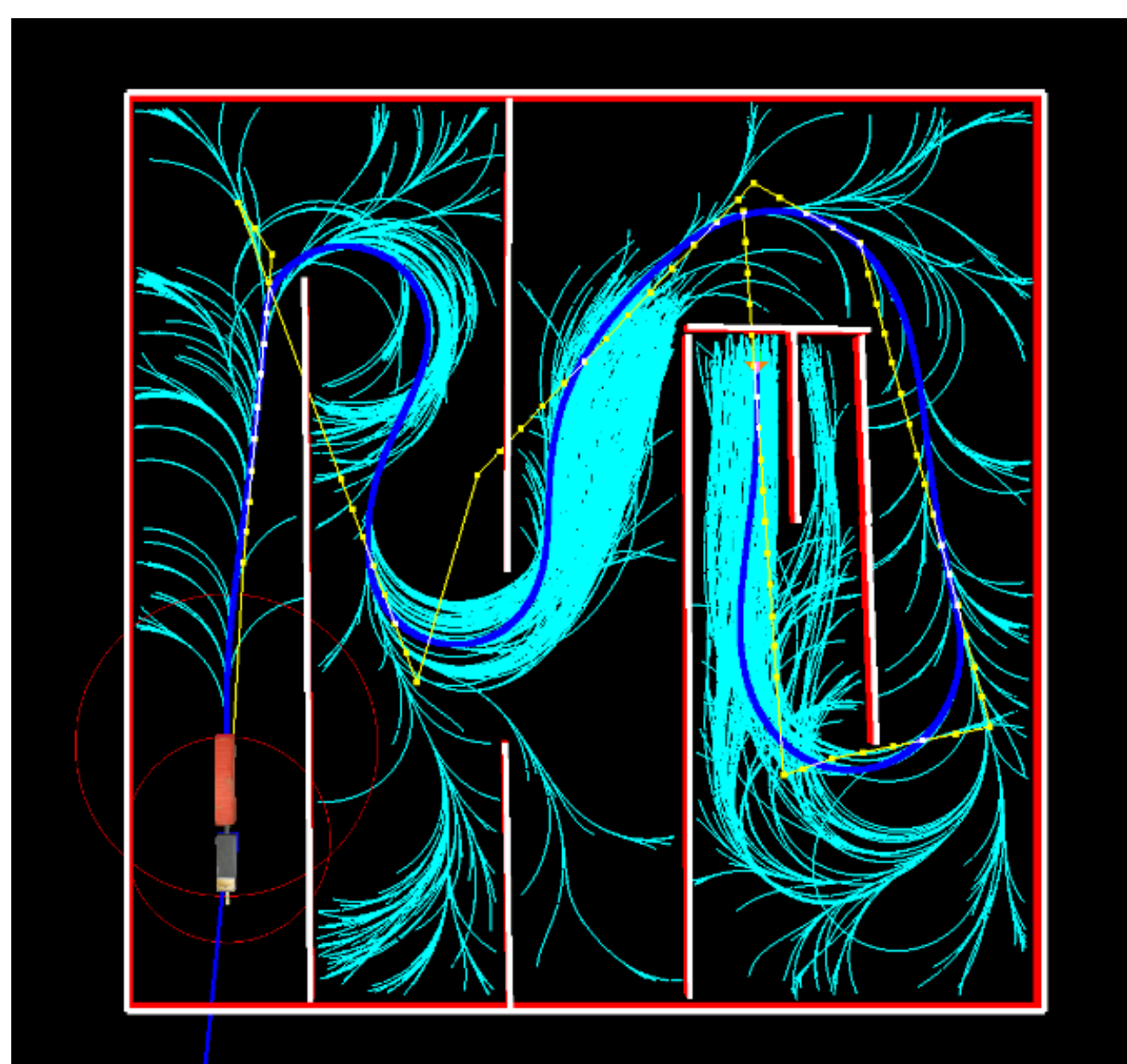
- The past decades have witnessed a rapid increase in autonomous vehicle research.
- Motion planning and classical control are two areas where an extensive amount of research has been done. However, most of the work in these two areas seems to have been performed independently of each other.

Research Goal & Questions

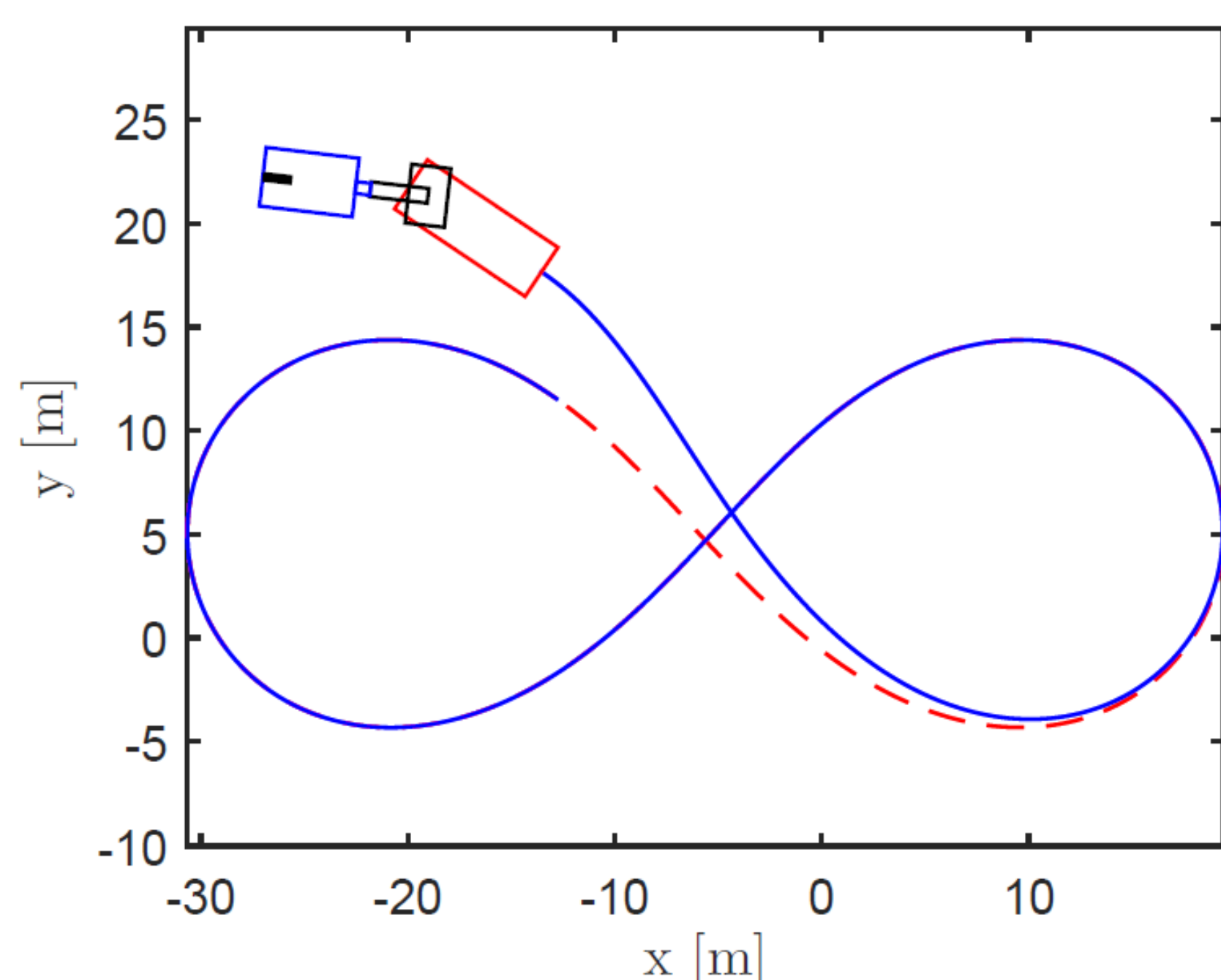
- Our research goal is to merge results from classical control and motion planning in a way such that the combined knowledge can be used to be able to guarantee closed-loop stability and enhance the overall performance for self-driving vehicles.



Methods & Preliminary Results



- Three accepted publications in peer review conferences during 2016; IV, IROS and CDC.



- All results are and will be implemented and tested on real applications in close collaboration with industry.

Roadmap & Milestones

- Develop and implement motion planning algorithms and path following controllers on full-sized truck and trailer systems.
- Develop methods to a priori be able to guaranty closed-loop stability around paths with uncertainties acting on the system.
- Investigate if it is possible to develop planning methods to be able to guarantee closed-loop stability in presence of replanning by combining classical results from control and motion planning.
- Develop and implement other controller structures for truck and trailer systems and the possibility to extend the results to more complex vehicle configurations such as "En Trave Till".

Architecture for the closed-loop system with its local planner and path following controller:

