# Formation Path Planning using Model Predictive Control

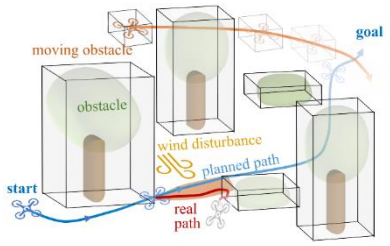
TECHNISCHE UNIVERSITÄT DARMSTADT

**Proposal for a Master's Thesis Topic**

In recent years, the task of covering and exploring an unknown area using multiple unmanned aircraft vehicles (UAV) equipped with onboard sensors has received significant attention. Applications include surveillance/inspection of complex structures, forest fire detection, and search and rescue missions. To execute those tasks faster, multiple cooperative drones can be used. Even though it is usually the best to let the swarm split up, some tasks require a certain formation of the UAVs, e.g. if laser-based sensors and reflectors are used. Therefore, it is of interest to expand an existing path planning algorithm for multiple UAVs by different methods that achieve certain formations. Depending on the application scenario, the formation does not need to be rigid but should be kept rather lose if narrow spaces have to be passed. The effectiveness of the adapted methods can then be shown in simulation studies. The work will be carried out in cooperation with the Institute of Flight Guidance at the DLR in Braunschweig.

The work is structured as follows:

1) Literature research about formation flights of fixed wing, rotatory wing aircrafts as well as ground vehicles
2) Adaption and integration of 2 methods into an existing multi-agent path planning tool
3) Implementation in C++ (Visualization of simulation results via Matlab)
4) Validation and comparison of simulation results

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| Experience with / knowledge about: | Mixed Integer Linear Programming (MILP), Optimal and Model Predictive Control (OC, MPC) |
| Programming skills: | C++ |
| Language: | German or English |

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CCPS Control and Cyber-Physical Systems