Technische Universität Graz
Erzherzog-Johann-Universität

Institut für Fahrzeugtechnik

# Master Thesis

## Autonomous Driving in Forestry and Off-Road Environments: Challenges and Technological Approaches

### Motivation & Goals:

Forestry is an essential sector of the economy in Austria and Europe, where modern machines play a central role in wood harvesting, processing, and transport. However, working conditions in forestry and off-road areas are particularly demanding, as the machines must operate in difficult-to-reach mountainous and valley regions. Currently, these machines are mostly manually operated and powered by combustion engines, which not only incur high operating costs but also generate significant emissions. Autonomous driving systems offer a promising opportunity to enhance efficiency and safety in forestry and off-road areas while simultaneously reducing energy consumption and environmental impact.

**The aim of this work** is to analyze the challenges and technological approaches for autonomous driving in this specific application. Existing systems as well as new developments in sensors, navigation, drive strategies, and environmental adaptation will be examined and evaluated. The work intends to contribute to the advancement of autonomous driving concepts in forestry and off-road sectors and demonstrate their potential for more sustainable and efficient forest management.

### Work Tasks:

- **Analysis of Challenges:** Investigation of the specific conditions and requirements for autonomous driving in forestry and off-road areas (e.g., rough terrain, weather, obstacle detection).
- **Technological Approaches:** Overview of current sensor technologies, navigation methods, and control algorithms for autonomous vehicles in unstructured environments.
- **Electrification and Energy Efficiency:** Evaluation of the integration of electric drives and efficient motion strategies to reduce emissions and operating costs.
- **Assessment and Potential Analysis:** Comparison of existing solutions, identification of optimization potentials, and estimation of the economic and ecological impacts of autonomous driving processes in forestry.
- **Prototype Development:** Design and implementation of a prototype autonomous vehicle for testing and evaluating sensors and control algorithms in forestry and off-road environments.

| | |
|---|---|
| **Duration:** | 6 Months |
| **Start:** | As from now |
| **Workplace:** | Institute of Automotive Engineering & Industry partner |

A **scholarship of € 3.500** will be granted for the successful completion of the master's thesis.

Contact: Research Group Automotive Mechatronic Product Development
Dipl.-Ing. Dr.techn. Alexander Kreis, alexander.kreis@tugraz.at, +43 664 88878948

http://ftg.tugraz.at

05.03.2025