

MECH 4007 VEHICLE ENGINEERING II

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Winter Semester – 36 hours

Objectives: This course introduces the student to a range of facets related to off-road vehicle analysis and design with an emphasis on planetary rovers for space exploration. Although the applications are primarily for planetary rovers, the techniques are applicable to any off-road vehicle. It will be shown that mechanics and control cannot be regarded independently due to the interactions between them particularly for all-terrain applications. Hence, aspects of control will form a major part of the course. A series of special topics will be covered on biomimetic aspects to vehicle design.

Syllabus:

1. Chaos theory and chaotic nature of ground traverse
2. Planetary rovers as off-road vehicles
3. Planetary terrains
4. Chassis design – merits of wheels v tracks
5. Special topic I: Biomimetic locomotion
6. Terramechanics I – traction analysis
7. Terramechanics II – Bekker theory
8. Electric motor control for vehicles
9. Special topic III: Neural Network Controllers
10. Robotic vision & autonomous navigation (SLAM)
11. Mining & Factory Vehicles
12. Robot Swarms for planetary mining and construction
13. Special topic IV: Biomimetic navigation

Recommended Text:

Ellery A (2016) *Planetary Rovers*. Springer-Praxis Publishers, Chichester, UK

Wong J (2001) *Theory of Ground Vehicles*. 4th Edition, John Wiley & Sons Inc, New York, USA

Grading Scheme: The grading scheme will be of the following form:

Mid-term presentation: 10%

Project final: 40%

Final examination: 50%

For all exams you are permitted to utilize two A4 sheets of paper (both sides) annotated accordingly.

Project: You may choose your own project on a relevant aspect of Vehicle Engineering