Mechanical Engineering
Dynamics System

Vehicle Engineering

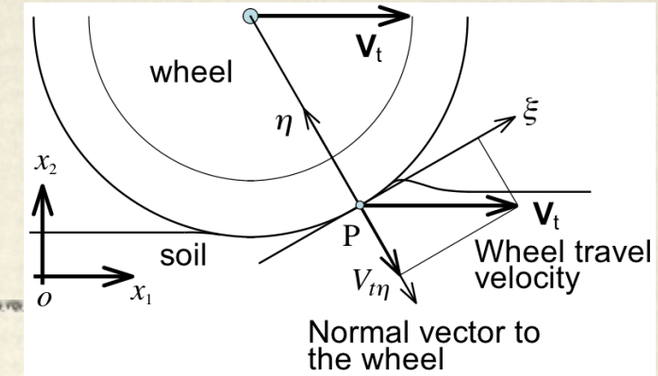
Professor
Keiji Watanabe

Professor
Junya Yamakawa

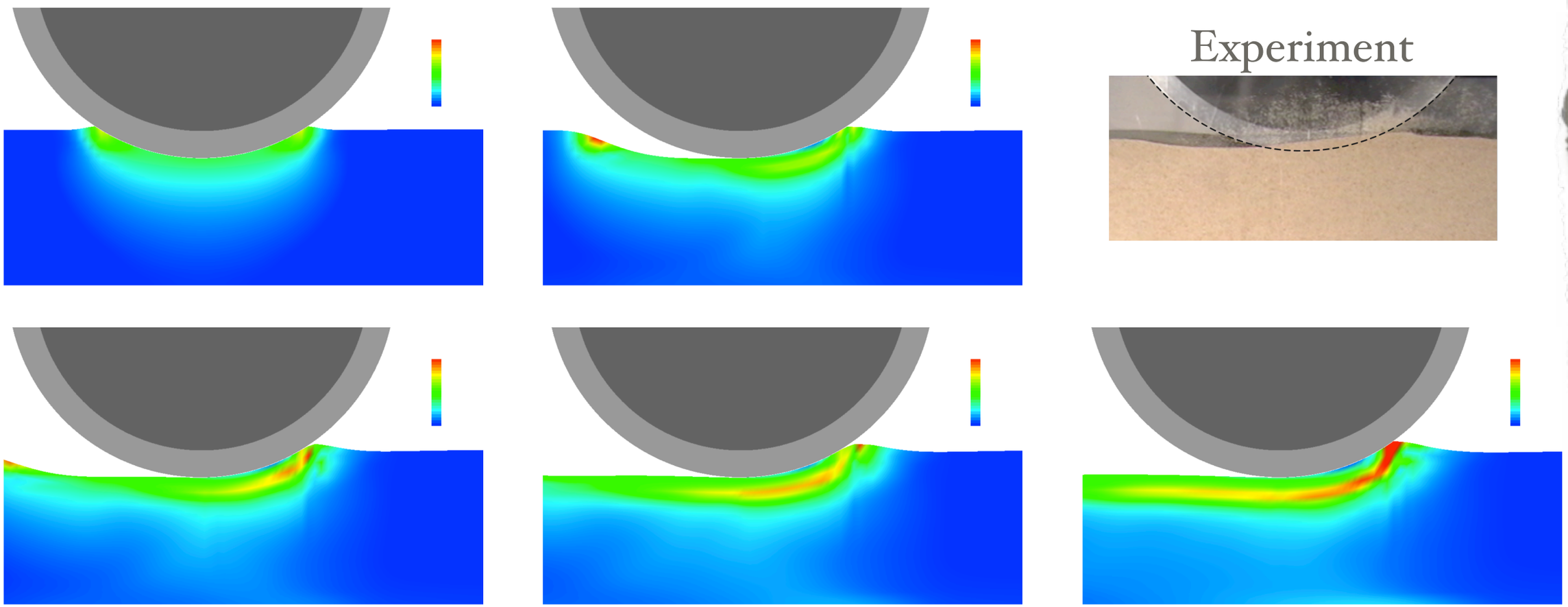
Research Field

- Interaction between off-road vehicles and ground
  - To establish the relationship between kinematical variables and interactive forces of ground and running gears (tire, crawler, rigid wheel, etc) as numerical models and to utilize them to improve performance of off-road vehicles.
- Modeling of off-road vehicles and motion analysis
  - To establish vehicle models for motion analysis on various ground and to apply them to estimation of vehicle performance, control of autonomous vehicles, and others.

Research topic 1



- Wheel trafficability on soft ground
  - Approach with both numerical method and experiment

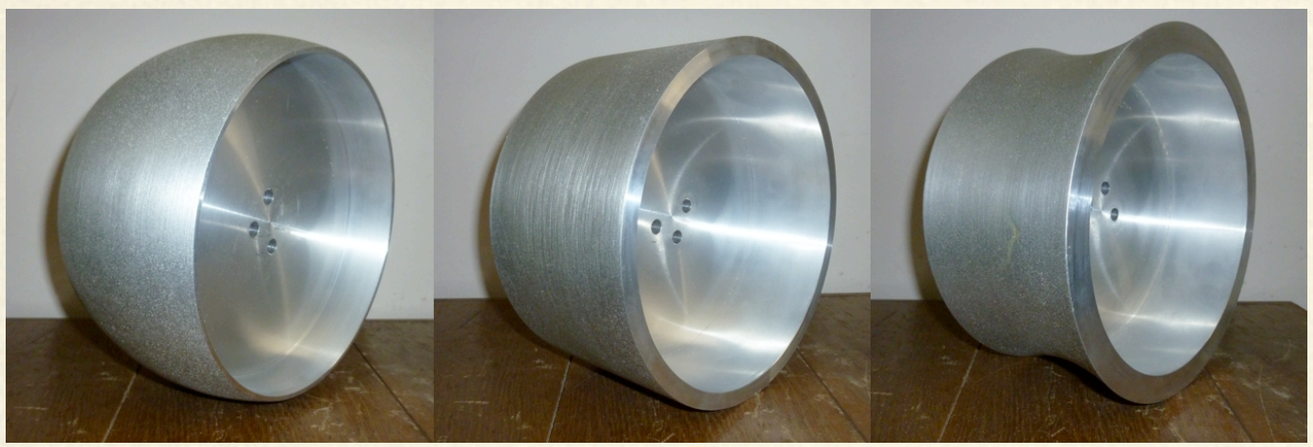


Experiment

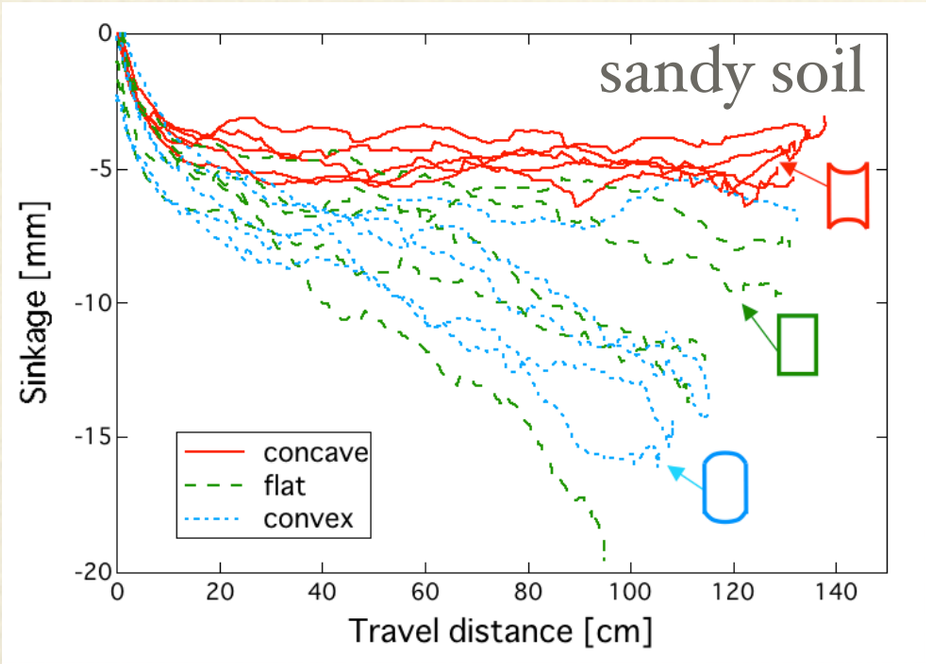
Numerical simulation with ALE FEM（Total strain norm）

Research topic 2

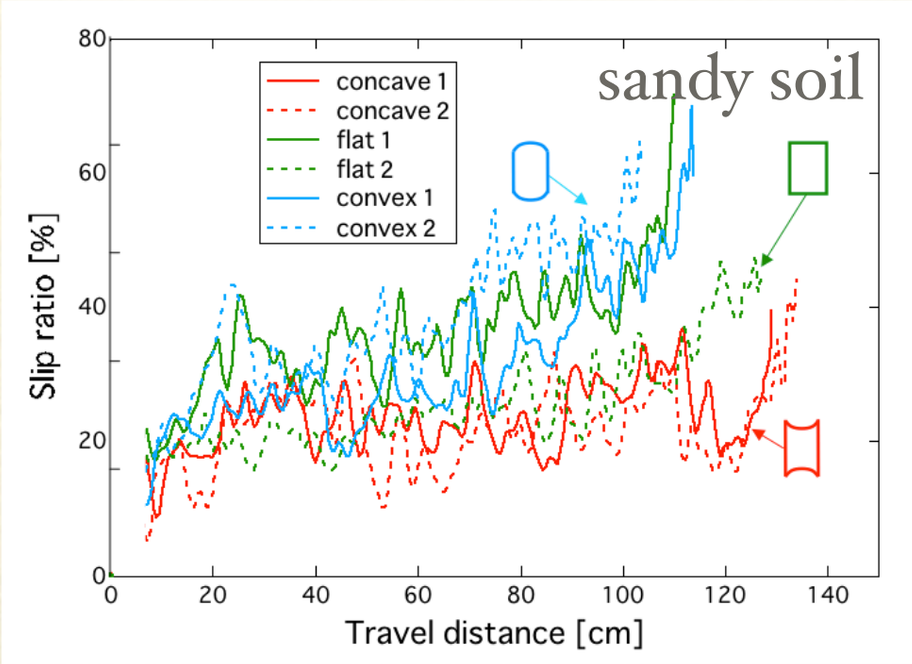
- Effect of wheel tread shape on trafficability
  - Find the optimal tread shape to reduce sinkage on soft ground



Wheels with three different tread shapes



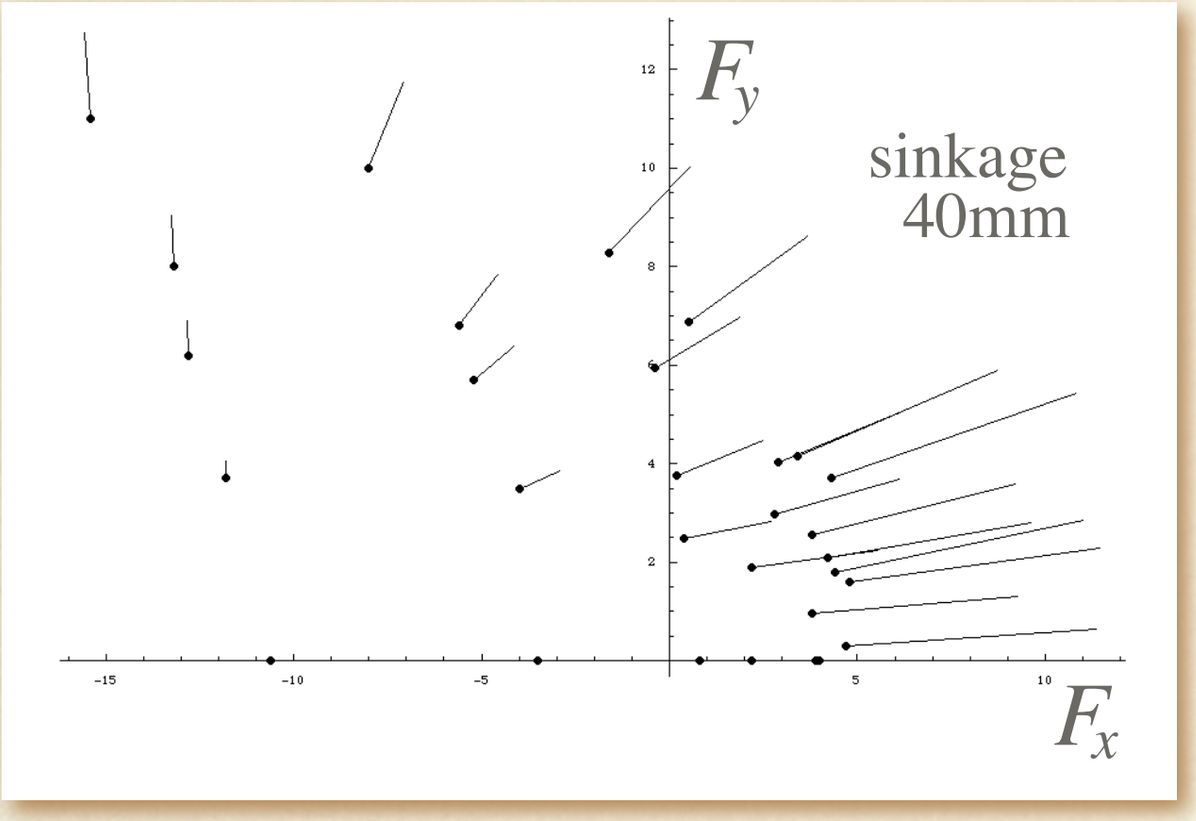
Sinkage of wheels on travel



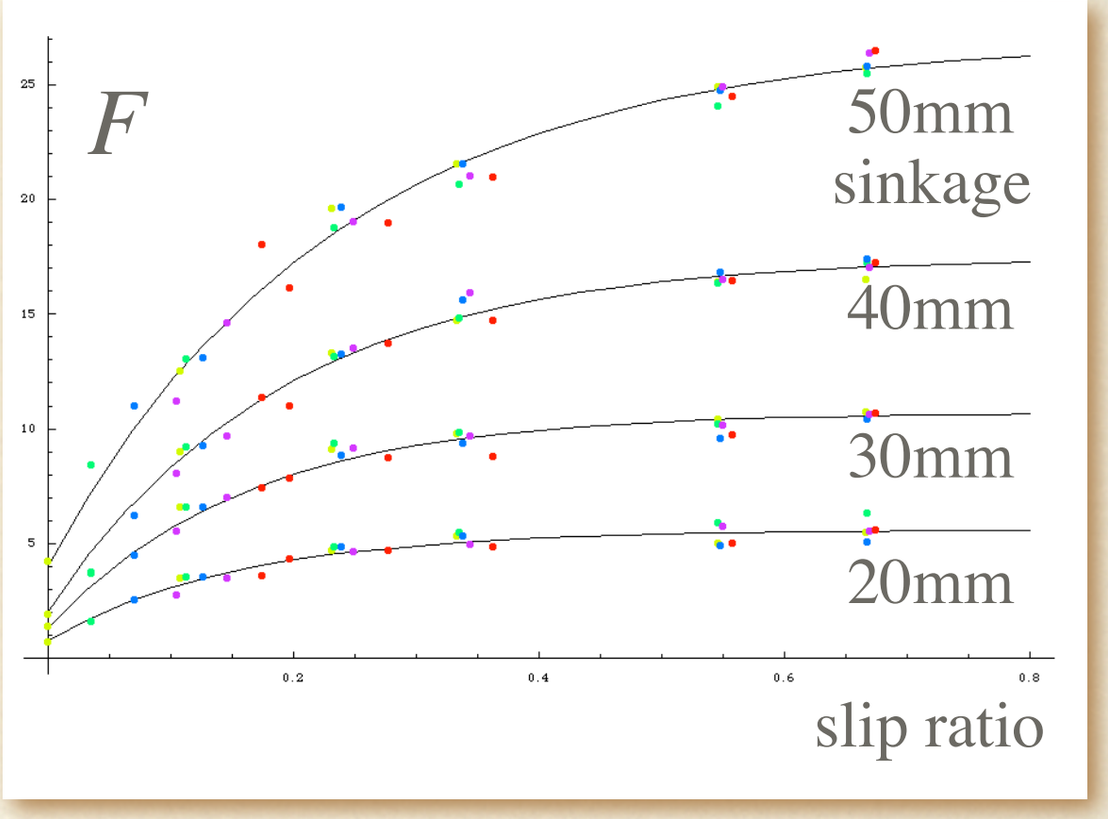
Slip ratio on travel

Research topic 3

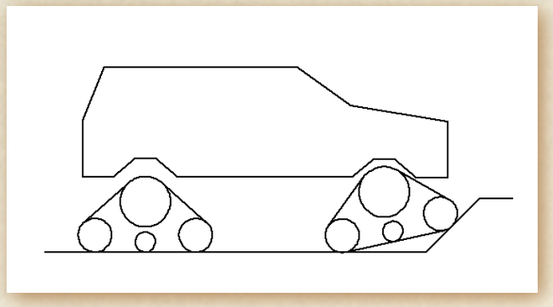
- Construction of tire models for vehicles traveling on dry sand



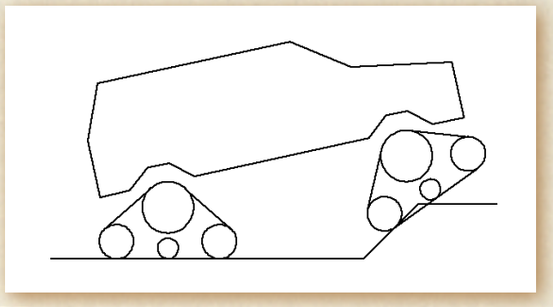
Longitudinal and lateral forces on tire and slip directions



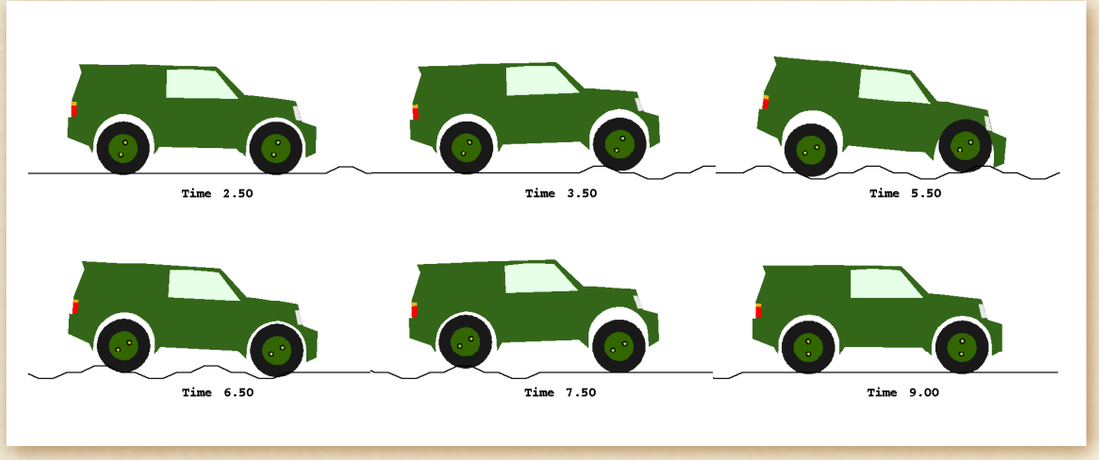
Norm of tire force and slip ratio (Experiment and numerical model)

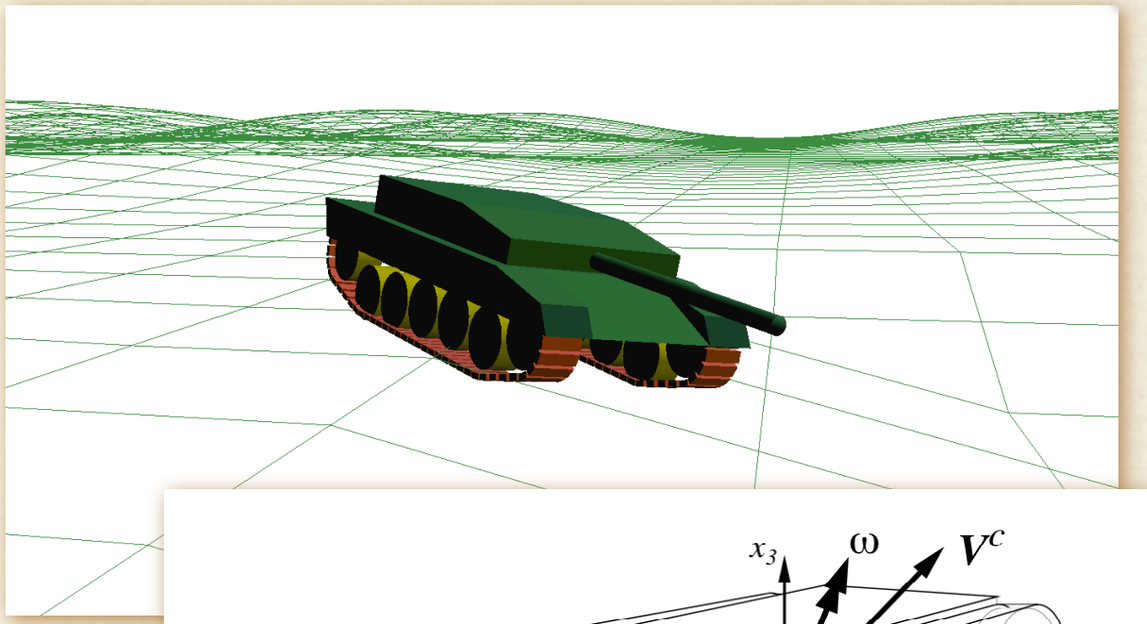


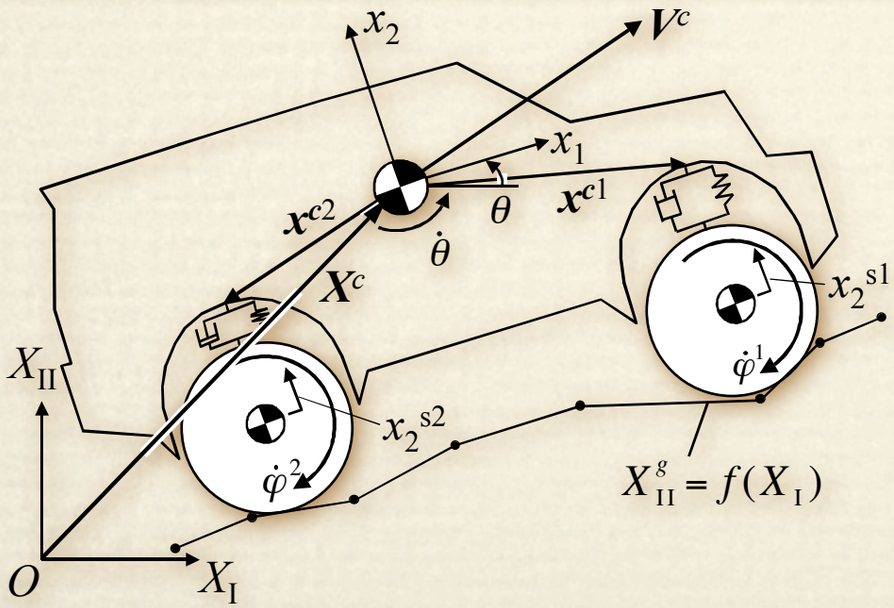
Research topic 4

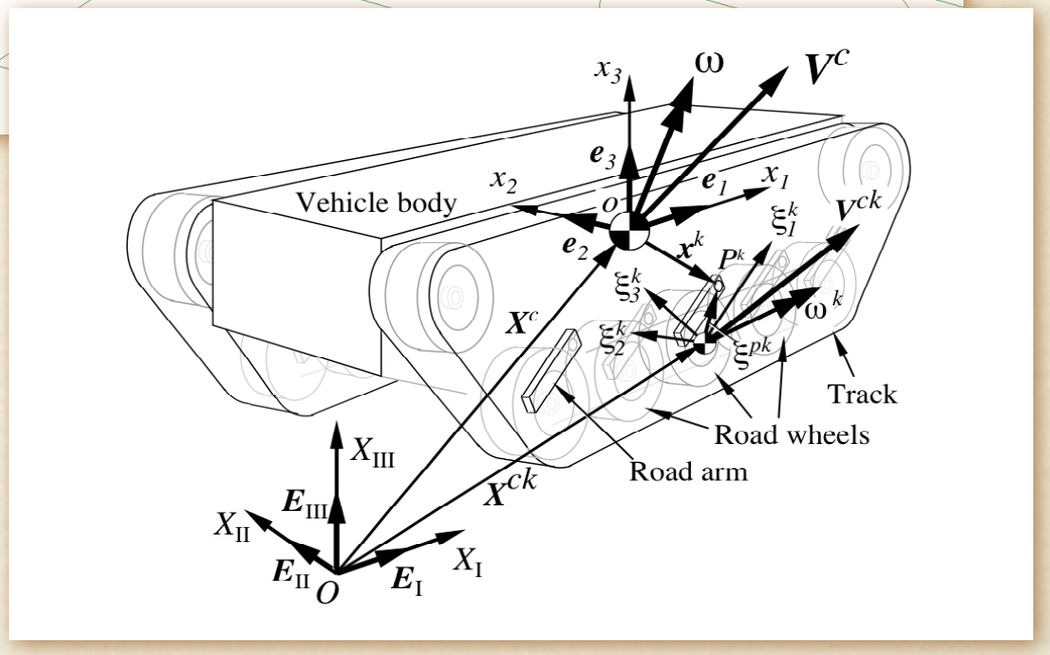


- Vehicle model and motion analysis
  - To construct numerical models of various off-road vehicles to simulate their motion









Publication in 2010-2012

- Junya Yamakawa, Shu Yoshimura, Keiji Watanabe: A Tire Model for Vehicle Motion Analysis on Dry Sand, *Proceedings of the Joint 9th Asia-Pacific ISTVS Conference and Annual Meeting of Japanese Society for Terramechanics, CD-ROM*, Sapporo, 2010
- Junya Yamakawa: Approaches to Wheel Motion Analysis by ALE Finite Element Method, *Terramechanics*, *Vol. 31, pp. 69-73*, 2011
- Junya Yamakawa: Soil-Wheel Interaction Analysis with ALE Finite Element Method, *Proceedings of 17th International Conference of the International Society for Terrain-Vehicle Systems, CD-ROM*, Blacksburg, USA, 2011
- Masashi Akahane, Junya Yamakawa: Study on Wheel Profile to Reduce Sinkage on Sandy Soil, *Terramechanics, Vol. 32, pp. 49-54,* 2012