

# A framework of vehicle-bridge interaction system for nonlinear seismic response analysis

Han Zhuoran (M1) 2020/3

Infrastructure Innovation Engineering

Dept. C.E.R.E., Kyoto Univ.

## Background

- The seismic design code of Japan ignores the presence of vehicles, which is an inappropriate simplification according to many pieces of research.
- We must understand the vehicle-bridge interaction (VBI), but it is a coupled nonlinear system, very difficult to simulate.
- As a result, most researches are limited to simple cases.

## Objective

- I want to build a framework to simplify and speed up the simulation while preserving many flexibilities.

## Approach and progress

- Previously, I have investigated the strengths and limitations of commercial software, Abaqus. It is fast, accurate but costly.
- Abaqus is extremely fast but slows down at I/O and restart. It also lacks flexibility for vehicles such as smooth entrance, exit, and most importantly, almost impossible for real-time vehicle behaviors.
- Rather than complex models, line models and shell models are faster and accurate, but the line model doesn't support contact with point mass in 3D. Shell model, on the other hand, is weak on road roughness.
- These limitations are close to declaring the unsuitability of Abaqus for my aim, despite the superior performance of it in similar cases.

## Future

- It seems that only a code-based nonlinearity-capable platform can deal with the problems, which is the OpenSees. For the next year, I will focus on the linear case first and try to build a prototype of the framework, and then migrate it to OpenSees platform. If it finally works and is well verified, many data can be obtained, and many kinds of research can be conducted with it.