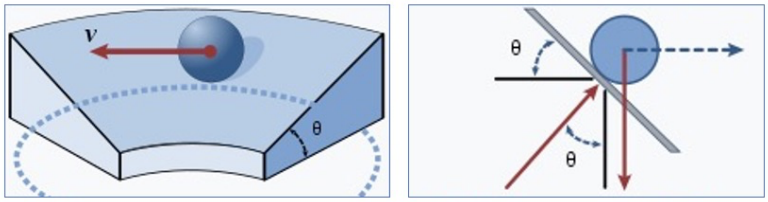
ME 274 – Data Science Activity – Spring 2024

Posting a Speed Limit Sign on a Banked Turn

Due: 11:59PM, Wednesday, March 20



Objective

You are a West Lafayette city engineer. You are responsible for posting the speed limit sign on a banked turn on a road that you are designing. You need to calculate the maximum speed that a car can travel around the banked turn without slipping. You can do this with dynamics. The problem is that drivers do not necessarily obey the posted speed limit. Some will go faster than the speed limit. Your objective is to decide what speed limit that is safe for most drivers (even those who do not obey the speed limit). You will achieve this goal through the following steps:

- Use dynamics to calculate the maximum speed that a car can travel around the banked turn without slipping.
- Use data from driver feedback signs to quantify the distribution of speeds that drivers choose given a posted speed limit.
- Pick the posted speed limit so that 99% of the drivers travel at a safe speed (even those who do not obey the speed limit).

Data Science Learning Components

- Python programming.
- Data visualization.
- Data analysis.
- Data interpretation.

Activity Description

A banked turn is a turn, or change of direction, in which the vehicle banks, or inclines, towards the inside of the turn. The banked turn is a common feature of highways, railways, and roller coasters. The banked turn allows the vehicle to go around it at a higher speed than would be possible if the road surface was flat. For this assignment, you are to:

- Solve *Example 4.A.14* from the ME 274 lecture book.
- Review the assignment description here, and as posted on the *Homework/Discussion* page of the course website.
- Complete the tasks on the Jupyter notebook found at: https://colab.research.google.com/github/ebilionis/core-me-data-science-activities-public/blob/master/me274/activity_01.ipynb
- Download the PDF of your completed Jupyter notebook and submit on Gradescope by the due date.

Additional resources

- Short video describing how Google Colab works: https://www.youtube.com/watch?v=Donm9d8F9Xw
- Video providing additional explanation of this data science activity: https://www.dropbox.com/scl/fi/ijmvh1tn2qilk8ig6c5pw/activity_explanation.mp4?rlkey=nbrnine58huzt09n69knsz3qi&dl=0