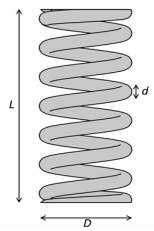
CNST-H-421: Structural Analysis and Finite Elements (2025-2026)
Project Identification Sheet
Group : Projet FEM (Membres : El Mankouri Ibrahim, Sow Ibrahima, Maximilien Zarioh)
Project : Analysis and Calibration of Suspension Spring Stiffness (Kawasaki ZR-7 1999)

1. Questions to be analysed

The main objective is to numerically determine the axial stiffness of the front and rear suspension springs of a 1999 Kawasaki ZR motorcycle. Our specific tasks are:

- Develop a simplified 3D finite element model to estimate the stiffness of the springs.
- Calibrate this model using the known experimental stiffness of the front spring.
- Predict the stiffness of the rear spring using the calibrated model and compare it with the experimental measurements that will be collected later.



2. Geometry of the rear spring

At this stage, the exact dimensions of the rear spring have not yet been measured. The model will therefore be built using the standard geometric parameters of a helical compression spring: the free length **L**, the outer coil diameter **D**, the wire diameter **d**, and the number of active coils **n.**

3. Material properties

The rear spring is assumed to be made of standard spring steel, as commonly used in motorcycle suspensions. In the absence of a manufacturer datasheet, the following typical elastic properties are used: **Young's modulus**: E≈210 GPa and **Poisson's ratio**: ν≈0.30. These values provide a reasonable first approximation of the mechanical behaviour of the spring.

4. Estimation of Loads and boundary conditions

Motorbike : 2060N (210kg), Driver : 785N (80kg), Fuel : 160N and total charge : 2845N
Boundary conditions will reproduce a standard compression test:

- the bottom end of the spring is fully fixed,
- the top end receives the imposed axial displacement, while remaining free to move laterally if necessary so that no artificial bending is introduced.

5. Adjustment

After both stiffness values are available, the FEM results will be compared to the experimental measurement. If the numerical stiffness differs from the experimental one, the model will be:

- updating the geometry with the real measured dimensions,
- adjusting the number of active coils (since the end coils do not always deform),
- refining the mesh if necessary,
- or slightly adjusting the material parameters within realistic limits.