

Car Suspension Modeling

Implementation

Background Material for the Car Suspension Model

The modeling activity on car suspensions assumes that students have grappled with second order linear homogeneous differential equations with constant coefficients. Here are suggested options:

- The instructor may cover the pre-requisite material entirely on her/his own
- The instructor may use the following to cover, and possibly assess, the pre-requisite material. This portion can be particularly valuable in a remote environment.
 - The video files "01.Order2LinHomConstCoeff_part1.mp4" and "01.Order2LinHomConstCoeff_part2.mp4" provides an active learning overview of prerequisite material. This includes some informal "think..." questions along with more formal questions to assess the understanding. Students can turn this in prior to seeing the answers.
 - The video file "02.Order2LinHomConstCoeffANSWERS.mp4" has the answers to the preliminary questions

The instructor can decide whether or not to grade the student responses to the background material. The rubric assumes they are graded.

Car Suspension Modeling Activity for Students

Students should submit their responses from the modeling activity. Students should label individual questions as in the handout.

Provide students with the text-based version of the activity that also lists resources and has some comments of interest.

- file "3-034-S-CarSuspensions-StudentVersion.pdf"

If desired, also provide the video version.

- video files "03.CarSuspensionActivity_part1.mp4" and "03.CarSuspensionActivity_part2.mp4"

Both have a concluding question,

10. Write a short description of how differential equations can model a simple car suspension system.

If desired, grade separately for components: *Summarize the situation you are modeling*Characterize undamped, underdamped, and overdamped situations*Indicate the effect of additional mass *Describe the effect of installation angle

Teacher's Answers for the Car Suspension Modeling Activity

Instructors can see the answers to the modeling activity

- file "3-034-T-CarSuspensions-TeacherVersion.pdf"

as well as a Mathematica document with solutions, and its pdf version, for instructors

- file "CarSuspensions-TeacherVersion.nb"
- file "CarSuspensions-TeacherVersion.pdf"

Teacher's Assessment for the Car Suspension Modeling Activity

See the suggested Assessment document with a Rubric for grading the background material and the main modeling activity, along with learning outcomes, and possible additional assessment questions.

- file "CarSuspension-Assessment.docx"
- file "RubricGradeSheet.xlsx"