Vibrations in elastic structures

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Within this research theme all kinds of projects can be formulated to study the vibrations in elastic structures such as bridge cables, overhead power transmission lines, conveyor belts, elevator cables, micro or nano electro-mechanical systems, and so on. In these elastic structures all kinds of vibrations and resonances can occur. To avoid or to reduce undesired vibrations, damping mechanisms can be attached to the elastic structures. Mathematical modelling usually leads to initial (-boundary) value problems for (partial) differential equations. But also formulations with difference equations or differential delay equations are possible. Formulating a mathematical model, analysing the problem with analytical (and numerical) methods (such as perturbation methods, bifurcation methods, ..), and developing analytical methods to study these problems, are the core business for all students in these projects. Depending on the preferences of a student, and with the student a problem will be chosen, and will be formulated.

Further information : To give further information on these projects interested students are requested to send an email to w.t.vanhorssen@tudelft.nl in order to make an appointment.

Examples of MSc and BSc projects in the last 10 years : (see also the TU repository for the theses)

1. The mathematical analysis of problems describing the dynamics of pipes conveying fluids (2023)
2. Stability of four-body kite central configurations (2022).
3. Modelling fluid-structure interaction in offshore photovoltaics (2022).
4. On the influence of constant vertical windspeed on the classical Ekman spiral (2021).
5. Wave reflections in a semi-infinite string due to nonlinear energy sinks (2020).
6. Analysis of the response of a simply supported microbeam subject to an electric actuation (2020).
7. Reflections of waves in infinite strings due to mass-spring-damper attachments (2020).
8. Reflections of waves induced by a nonlinear spring at the boundary (2020).
9. A perturbation method for differential delay equations (2019).
10. On stability of a harmonic oscillator with a delayed feedback system (2019).
11. Limit cycles in mass-spring systems with snap-through mechanisms (2018).
12. A cascade of auto-resonances in an accelerating elevator cable system (2017).
13. On the rain-wind induced vibrations of a mass-spring system (2016).
14. On longitudinal vibrations in the hoist cables of the Pieter Schelte (2015).
15. The destabilization and stabilization of Brouwer’s rotating vessel (2015).
16. On rain-wind induced vibrations of an oscillator with a time-varying mass (2014).