Project Thesis / Master Thesis

Nonlinear vibration localisation in a mistuned lumped mass model

Turbines are complex machines that are used in a variety of applications such as power generation, aviation and marine propulsion. However, turbines are subjected to various types of vibrations that can cause damage, reduce efficiency and compromise safety.
Mistuning can occur due to manufacturing tolerances, material variations or damage of the blades and can lead to high amplitude, localised vibrations. Another reason for localisation are nonlinearities that can occur in turbines for various reasons (e.g. geometric nonlinearities, friction, contact). For the structural dynamic investigation, turbines can be understood in a very simplified way as an arrangement of nonlinear mass-spring elements, so-called lumped mass models. The harmonic balance method (HBM) is a spectral Galerkin method suitable for performing frequency response analysis of these nonlinear models.

In this work, the interaction of mistuning and nonlinearity is to be further investigated using a lumped mass model. The scope of work covers the following tasks:

- Literature review of the state of the art
- Lumped mass modelling
- Numerical investigation via HBM with the Matlab Toolkit NLVib and comparison to time integration

For the completion of the tasks, existing programming knowledge in Matlab is necessary, as well as experience in the field of structural dynamics. In addition, an independent work style is a prerequisite.

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