



## Generic determination of the damping properties of composite materials for design application

(Experimental/Simulation/Literature)

**Keywords:** Dynamic Analysis, Damping, Composites, Natural Fibers, Experimental, Simulation

### Background:

In the design of helicopters, the considerations of dynamic loads and vibrations are of great importance. This also affects the helicopter tail, which is dynamically excited by the Rotor Wake in forward-flight. Unfortunately, the decisive loads are difficult to predict in early design. As a result, problems with the tail boom are often only discovered in the flight test phase on the prototype, which results in expensive changes and lengthy delays in the development process, as the previous design processes from TUM Partners showed.

Since the exact frequencies and excitations in the early stages of development are unknown, one approach to reduce the risk is to increase the overall damping of the tail to counteract critical aeroelastic effects. The Institute of Helicopter Technology is investigating how to reinforce the composite structure of the horizontal tail with flax fibers. Natural flax fibers offer a significantly higher damping potential when used in hybrid composites than single carbon fibers.

**Goal:** Since the current knowledge on flax fiber composites does not include sufficient knowledge on the dynamic behavior of the prepreg materials used, the material's damping has to be determined on a generic level. For this purpose, this thesis envisaged that test specimens in the sense of Rouchon's test pyramid have to be manufactured at coupon level, tested with frequency response analyses (experimental modal analyses), and used to feed a numerical damping model. UD and cross composites and hybrids have to be tested in different fiber angles. Extensive literature studies must be carried out in advance to determine the current status of damping modeling and determination.

**About us:** We are looking for an independent and highly motivated student in his Master's who wants to improve his knowledge in helicopter-related design, dynamic analysis (FEM), and experimental work. This thesis offers an excellent opportunity to participate in applied and industry-related research. When interested, please feel free to contact us in person. We are happy to discuss all possibilities! We also offer a great range of thesis and Hiwi opportunities at the moment.

**Skills:** High motivation and the ability to independently familiarize with new topics. Experience in FEM and dynamics is an advantage but not necessary

**Tools:** Nastran(FEM)/Hypermesh/Python

**Language:** English/German

**Start:** 10/11.2021

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