

Institut für Mechanik und Thermodynamik

Professur Technische Mechanik/Dynamik

Introduction

There exist many countries with significant seismic problems, which are primarily located along major tectonic plate boundaries. Particularly, the so-called 'ring of fire' in the Pacific Ocean and the Alpine-Himalayan orogenic belt stretching from the Atlantic Ocean to Sumatra in Indonesia. These countries are frequently faced with earthquake waves due to moving tectonic plates. Especially, high-rise truss structures in these countries should be designed with a lowest natural frequency upper the typical frequency of seismic waves. Low-frequency seismic waves have a frequency below 4 Hz, where the wave frequency of regular earthquakes lies in the range up to 10 Hz. Numerical simulations and experiments with models are used for the design of such truss structures.

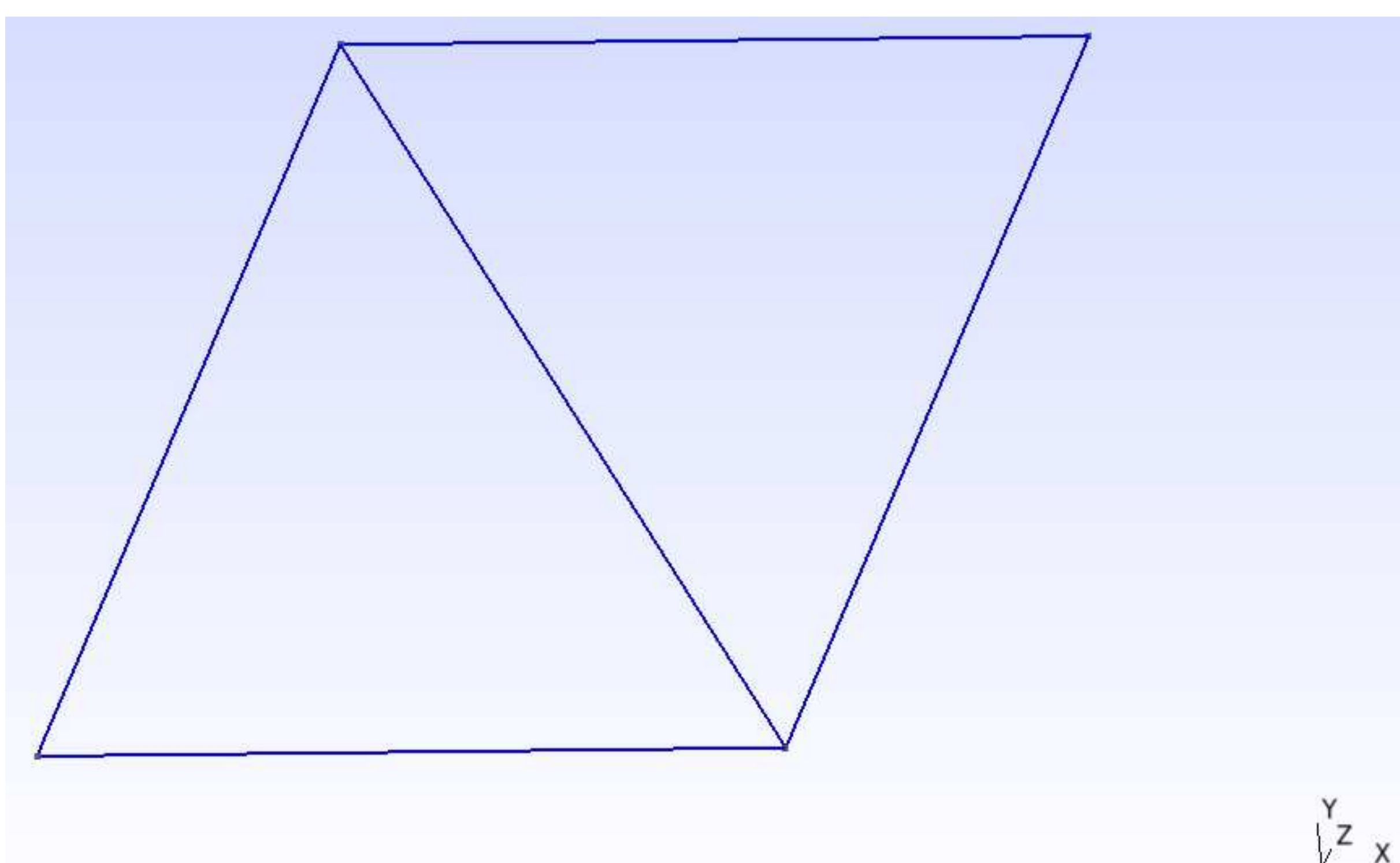


Fig.: Truss structure design in GMSH

Problem definition and work programme

Since in future a new material with actuator properties should be included in the transient truss simulation, a bespoke finite element code should be developed in the mathematical-based programming language MATLAB. Therefore, the goal of this work is the implementation of a transient finite element code for truss structures as well as the design of a simple test rig for an experimental verification of these truss structures, which were developed virtually with this finite element code. The preprocessing of the truss structure should be performed by GMSH (see Fig.) and post-processing by MATLAB. Starting the design of the truss structure by an eigenvalue analysis, the temporally dependent displacement excitation of the foundation should show the applicability of the truss structure subject to seismic waves. For the space and time discretization, linear Lagrange finite elements are sufficient. Literature and templates for the finite element code can be provided. A literature review associated with the seismic-wave resistant design of truss structures is part of the thesis. The test rig should include an existent shaker and the truss structure should be made of timber. A separable connection in the nodes of the truss structure would be desirable. The thesis should be authored in LATEX according to the template of the professorship.

Student: T.B.A.

Supervisors: Francesca Concas, Torsten Buschner

Auditor: Michael Groß