Karlsruher Institut für Technologie

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Investigations on the dynamic characteristics of frame bridges in the context of the railway

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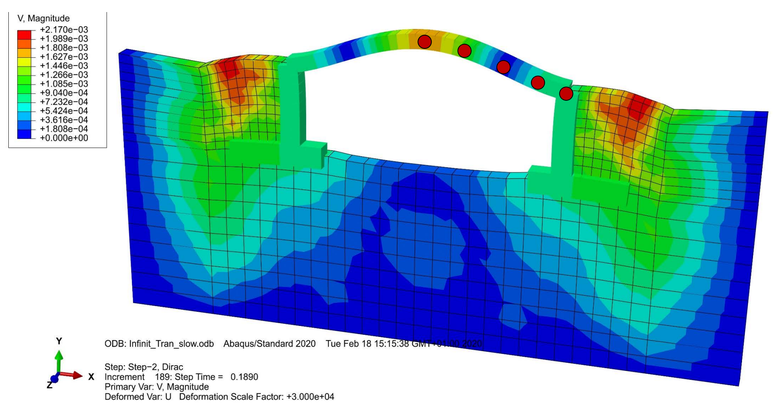
1. Motivation

The Railway system has changed significantly over the past few years, due to the expansion of German infrastructure. Since the ecological awareness becomes more important the industry moves more freight and individual traffic from the streets on to the rails.

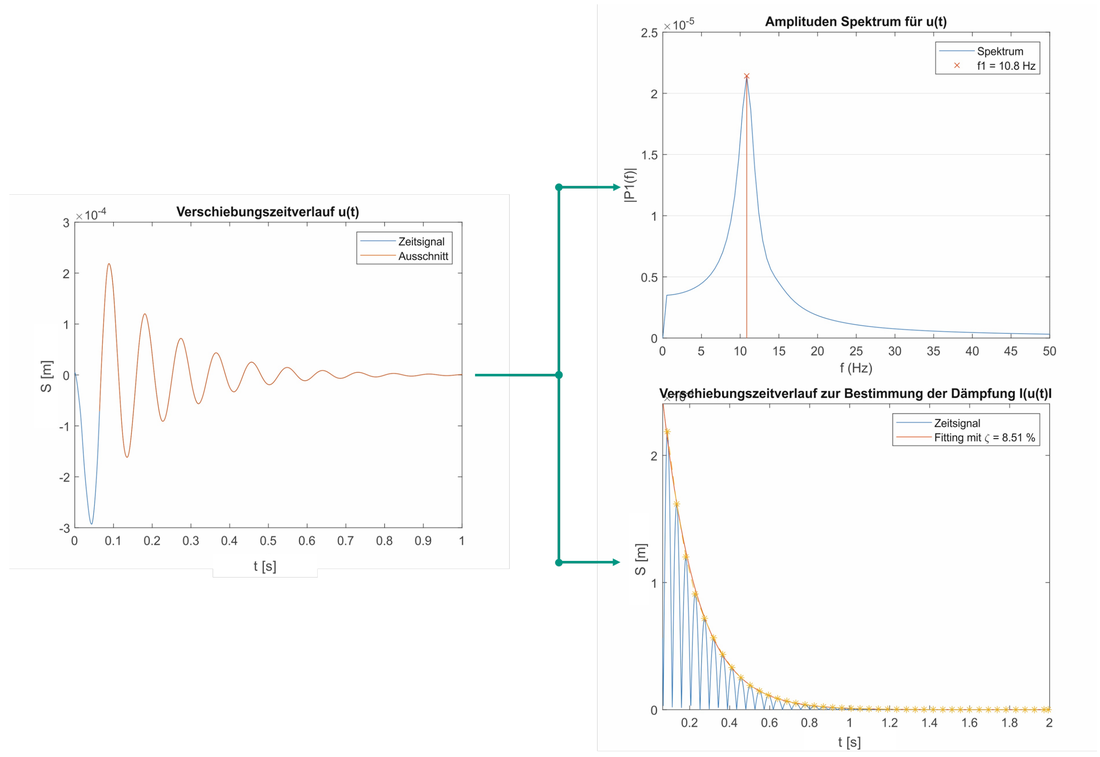
The refurbishments of various existing routes has shown a discrepancy between the assumed and actually measured dynamic characteristics of framework structures [2]. In practice, natural frequencies ($\Delta f \approx 150\%$) and damping parameters ($\Delta \varsigma \approx 300\%$) deviate considerably from the calculated values using FEM. In Particular the first natural frequency and its damping parameter is beyond acceptable deviations.

The resonance risk for railway bridge structures is evaluated according to the applicable standard (DIN EN 1991-2, 2010, or RIL804) through the first natural frequency. With the knowledge of the discrepancy shown for short frame bridges, the question arises how to deal with these bridges in order to work economically and on the safe side (approx. 18% of all railway bridges [3]).

2. Approach and Objectives



The project objective is to clarify, present and map the relationships between the geometric, soil-specific and material-related boundary conditions (e.g. soil-structure interaction, dynamic material behaviour, state II, extensions) and the dynamic behaviour. The decisive factors influencing the dynamic characteristics are to be identified and evaluated using parameter studies. If the correlations are present, they will be integrated into an overall concept/model, which will be tested with real structures.



Goals:

- Development of improved approaches for the consideration of subsoil damping in computer-based structural modelling
- Minimization of the discrepancy in the calculation of the natural frequencies by considering the decisive influencing factors
- Reduction of the developed approaches for application in practice

[1] https://de.statista.com/statistik/daten/studie/13343/umfrage/anzahl-der-ice-zuege-im-bestand-der-db-ag-seit-dem-jahr-2005/ - Zugriff am 18. Dezember 2019

[2] Reiterer, M. (Juni 2019). Dynamik von Eisenbahnbrücken: Diskrepanz zwischen Messung und Berechnung. Bauingenieur, S. D-A-CH- Fachteil.

[3] https://bruecken.deutschebahn.com/br%C3%BCckenkarte - Zugriff am 28. Februar 2020

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