Master's Dissertation at the Div. of Structural Mechanics

DYNAMIC BEHAVIOUR OF FOOTBRIDGES SUBJECTED TO PEDESTRIAN-INDUCED VIBRATIONS

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Background

The trend in footbridge design is towards increasing span, flexibility and lightness. As construction materials become more sophisticated, they can be more highly stressed under static loads. This leads to more slender structures, smaller cross sectional dimensions and greater spans. As a consequence, stiffness and mass decrease, leading to smaller natural frequencies with a greater danger of resonance. Many footbridges have natural frequencies with the potential to suffer excessive vibrations under pedestrian actions. If footbridges are designed for static loads only they may be susceptible to vertical as well as horizontal vibrations.

Recent experiences with the Millennium Bridge in London have shown how important subject the dynamics of footbridges is.

Objectives

The objective of this thesis is to study the vertical and horizontal forces that pedestrians impart to a footbridge. Special attention has to be given to the actions of several persons including the "lock-in" effect, which can lead to the synchronisation of a percentage of the pedestrians.

The Millennium Bridge in London

The thesis can be devided into four subtasks:

- Literature study of dynamic load-effects induced by pedestrians
- Comparison of design criteria in European, British and Swedish standards
- Dynamic analysis of the Millennium Bridge in London
- Parameter study and sensitivity analysis

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