Master's Dissertation at the Div. of Structural Mechanics

ANALYSIS OF VIBRATIONS IN HIGH-TECH FACILITY

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MAX-lab is a national laboratory operated jointly by the Swedish Research Council and Lund University. Nowadays, the MAX project consists of three facilities (three storage rings). A new storage ring is needed to improve material science, such as nanotechnology. MAX-IV will be 100 times more efficient than already existing synchrotron radiation facilities.

The floor of the MAX IV building will mainly be constituted of a concrete structure that is built on soil consisting of mostly boulder clay.

Since the quality of the measurement results from the MAX IV ring is dependent on the precision of the synchrotron light, a very strict requirement regarding the vibration levels are defined. The strict requirement is especially put in the vertical direction where the mean vibration level must be less than 26 nm during one second in the frequency span of 5-100 Hz.

The structure is exposed to both to harmonic and transient excitations. The harmonic excitation is typically working machines and transient excitations are typically traffic from the nearby roads and other human activities in the building such as walking.

The main objective is to study vibrations at the foundations to the synchrotron light subjected to diferent excitations. The aim is to establish realisic finite element models that predict vibrations in the foundation with high accuracy.

The ultimate goal is to prove the fulfilment of the needed requirements. If technical conditions are not fulfilled for the proposed structure, solutions to achieve them could be pointed out as well. The vibrations are analysed by the finite element method in both transient as well as steady state solutions. Since the models become very large, the technique of modal reduction is employed.

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