

Examensarbete

vid Byggnadsmekanik och Teknisk akustik

SEARCH FOR MASTER PROJECT CANDIDATE!

A PROPOSAL OF A MASTER PROJECT IN BUILDING ACOUSTIC AND STRUCTURE DYNAMICS: **STATISTICAL INVESTIGATION OF HUMAN WALKING PATTERN**

Beginning

As soon as possible

Supervisors

Delphine Bard, *PhD*

Div. of Acoustic Engineering

Kent Persson, *PhD*

Div. of Structural Mechanics

Examinor

Göran Sandberg, *Professor*

Div. of Structural Mechanics

To be performed at

Div. of Structural Mechanics,
Faculty of Engineering,
Lund University

Introduction to the project

There is a correlation between the weight, the size of the shoes and the height of the human, the walking impact load in both the vertical direction and the transverse direction for a male. The limitation of the gender depends on the fact that there does not exist a female walking load as a function of height and weight, due to the complex mass distribution of female bodies. However a statistical investigation of the human walking pattern in an arbitrary room with a finite size has not yet been done. The statistical investigation can lead to a reliable construction of a Brownian motor that simulates a reliable human walking pattern. Together with the known impact load in three directions, a human walking induced structure vibration prediction model for a lightweight timber floor can be constructed. Two scientific articles have outlined the main essence of the human walking impact load as a function of mass and height [1, 2]. With the help of all the experimental measurement values, a Brownian engine can be constructed [4]. The basic principle of the Markov chain can be found in a number of different literatures in mathematical statistical calculations [3]. This statistical method will give a reliable prediction model of the human walking induced load vector as a function of time, spatial variables and human characters

Task

- Investigate the human walking time history statistically
- Investigate the human walking angle and the length of steps
- Investigate walking pattern in an arbitrary room
- To calculate the expectation values and the corresponding variance of the human walking steps and step angles with the help of the a statistical calculation code where the basic linear regression analysis is assumed.
- To construct a human walking pattern, with the help of a Brownian motor code.
- To calculate the human walking induced time history with the help of Finite element software, MD Nastran 2006.
- To extract the transverse deflection of the floor structure in the post-processing to be able to calculate the flexure wave sound radiation.

References

- [1] Lievens, Matthias *MODEL OF A PERSON WALKING AS A STRUCTURE BORNE SOUND SOURCE* Proceedings of the 19th INTERNATIONAL CONGRESS ON ACOUSTICS in Madrid 2007
- [2] Alexander Ekimov and James M. Sabatier *Vibration and sound signatures of human footsteps in buildings* The Journal of the Acoustical Society of America – August 2006 – Volume 120, Issue 2, pp. 762-768
- [3] Daniel W. Stroock *An Introduction to Markov Processes* ISBN: 3540234519 Springer; 1 edition (May 31, 2005)
- [4] Albert Einstein *Investigations on the Theory of the Brownian Movement* ISBN: 0486603040 Publisher: Dover Publications (June 1, 1956)



**LUNDS
UNIVERSITET**
Lunds Tekniska Högskola