ABSTRACT

MS THESIS

Computer Simulation of Sound Insulation in Buildings

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The rapid development of technology not only results in positive effects on human life in various areas but also brings negative impacts every day. One of them is undoubtedly noise. Noise, a major problem of our era, unwittingly leads to many diseases. People need quite environments in their houses, offices precisely wherever needed. Therefore, insulated environments are indispensible and as a consequence, various insulation materials have been developed. Such materials include glass wool, rock wool, polyurethane soft foam, melamine foam, felt, perforated metal, perforated timber, perforated gypsum boards, floats, rubber foam, silencers, and acoustic laminated glass.

When examining literature, there are some studies on sound insulation using simulation techniques which is often employed in engineering disciplines. These studies can provide valuable information only in a short time about sound insulation properties of the materials by modeling the experiments with long term and high cost.

In this thesis, sound transmission loss values of building materials have been comparatively investigated using different sound insulation models. Comparisons are performed with Bastian, Akuzoft, Insul ve dBKAisla models and Comsol acoustics module. Among the models used, while Bastian has capacity for analysis in EN12354, ISO 140 and ISO 717 standards, Akuzoft is used in the computation of sound transmission loss for some materials. On the other hand, while Insul takes the material's surface mass and frequency into account in the calculations, dBKAisla can carry out 1/3 octave band analysis in EN12354 class. Finally, Comsol is a general purpose finite element based software package which can be also used in sound insulation problems.

In this work, the effects of sound insulation models are examined on the materials whose values of sound transmission loss that correspond different frequencies are determined by experiments. Also, by the comparative analyses conducted, the effects of insulation models on the sound transmission loss and sound reduction index of different materials are explored.

This thesis may allow the researchers from different disciplines to compute sound transmission loss without having prior knowledge about sound insulation by using insulation models and providing specific parameters of a material such as width, density, elasticity module, porosity, and internal loss factor.

Keywords: Noise, sound insulation, sound insulation model, insulation materials.