**SUMMARY**

The subject of this dissertation are issues related to the modeling and analysis of one-dimensional and two-dimensional phononic structures as models of acoustic partitions, including in particular industrial acoustic screens.

Detailed research concerns the propagation of mechanical waves in the analyzed structures in the range of acoustic frequencies. The occurrence of band gaps is investigated, i.e. the frequency ranges of mechanical waves that do not propagate in given structures, and the use of this phenomenon in the construction of noise barriers.

The work has been divided into parts that include an overview of the current state of knowledge, the purpose and scope of the work, descriptions of numerical methods used in the work, as well as methods of manufacturing and testing the properties of the analyzed structures. The research part consists of three main chapters in which the purpose and scope of the work are analyzed. Conclusions and final remarks are presented in the last part of the work. In addition, the thesis is supplemented with a summary in Polish and English, a list of important markings in the dissertation and lists of literature, tables and figures.

In the part on numerical methods used in the work, the method of modeling the propagation of mechanical waves in one-dimensional structures with the use of the Transfer Matrix Method algorithm was presented. This algorithm allows to determine the transmission of a

mechanical wave in the frequency domain for the examined structure. The propagation of the mechanical wave in two-dimensional space was analyzed with the use of the Finite Difference Time Domain (FDTD) algorithm, and the application of the fast Fourier transform of the resulting signals allowed to obtain power spectra and transmission structure. On the other hand, the use of the genetic algorithm made it possible to indicate the possibility of designing optimal material distributions in phononic structures.

In the fourth chapter (the first part of the research), wave propagation in one-dimensional phononic structures was analyzed. The influence of layer distribution on wave transmission and the occurrence of band gaps in its structure was investigated. Then, the solution space of the developed objective function was analyzed, which was later used to minimize the transmission and eliminate high transmission peaks with a small half-width thanks to the use of a genetic algorithm. The determination of the structure with the lowest transmission without dominant peaks was used to design the optimal distribution of layers in multi-layer acoustic partitions. A comparative analysis of the experimental and numerical results was carried out, showing the formation of the band gap areas. The possibility of using the developed algorithm to design two-band filters was also presented.

The fifth chapter analyzes wave propagation in two-dimensional structures. The influence of the material and shape of metaatoms as well as the lattice constant and types of metaatom distribution on mechanical wave transmission was investigated. A comparative analysis of numerical and experimental results was carried out, and a design of a selective filter reducing unfavorable components of the spectrum of mechanical waves generated by industrial devices was proposed.

In Chapter 6, taking into account the research carried out, which showed the possibility of selective transmission reduction depending on the geometry of one- and two-dimensional structures, CAD models of one-dimensional and two-dimensional acoustic barriers were prepared.

The last chapter presents a summary of the obtained results, and then indicates the possibilities of using the developed algorithms for other applications as well as suggestions for possible further research.