

Yuxia Guo et al. also found that when limestone powder is added, the strength of concrete at each age increases first and then decreases with the increase of adding amount. When the admixture is 20 %, concrete 3 d, 7 d and 28 d have the highest compressive strength. However, when the limestone powder content exceeds 20 %, the compressive strength of concrete decreases. This is due to the excessive amount of limestone powder, unreasonable concrete gradation, the content of coarse aggregate is relatively reduced, the skeleton effect is weakened. When limestone powder is added, the strength of concrete decreases obviously with the increase of the quality of limestone powder replacing cement. When the content is 10 %, the strength decreases significantly with the increase of age, indicating that the early strength loss of concrete is less when limestone powder replaces cement.

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**DIFFRACTION BY DOUBLY-CONNECTED CAVITIES OF
GENERAL FORM IN CASE OF NON-DESTRUCTIVE
DIAGNOSTICS OF ROAD STRUCTURES USING
GEORADAR**

Scattering of acoustic and electromagnetic waves by bodies of revolution (BOR) has been in a focus of numerous investigations for a long time. One of the reasons for the long-standing interest in this problem is the practical need for improvement to the reliability of the georadar target recognition (such as the pavement structure). Along

with wave scattering from solid BOR's, the solution of wave scattering problems for open thin-walled shells (cavities) is of important significance in modelling georadar targets (pavement structure, pipes, cracks in the pavement). These structures' spectrum consists of complex eigenvalues and their excitation is accompanied by sharp resonance peaks in the georadar cross-sections. In most previous studies, the wave scattering problem for open 2D and 3D cavities has been treated by purely numerical techniques. Our approach, called the Method of Analytical Regularization (MAR) is based on rigorous solution of the boundary (BOR) or mixed boundary (open shells) value problems for Helmholtz or Maxwell's equations. The rigorous solution is reduced for both acoustic and electromagnetic wave diffraction from the rotationally symmetric open spherical cavities with openings, including structures with one circular hole, two equal circular holes and equatorial circumferential slot. Another example of a scattering problem for rotationally symmetric doublyconnected cavities is hollow cylinders of finite length. This work was supported by Macquarie University Postgraduate Research Fund to analysis of the equations, known as matrix equations of the second kind. The main, distinctive property is the fast convergence of the algebraic equations; this allows us to obtain numerical results to arbitrary given accuracy. The high effectiveness of the MAR led to generalizations of the method to problems of wave diffraction by BOR's, formed by arbitrary smooth generating curves. In this research, we extend the applicability of the generalized MAR by solving a new wave scattering problem posed for rotationally symmetric doubly-connected cavities.

A new rigorous approach was developed for analysis of scalar wave diffraction by acoustically soft doubly-connected arbitrarily shaped surfaces of revolution. The structures contain two apertures of equal angular size and are formed by rotation of smooth generating curves.

We applied the recently developed generalization of the semi-analytical approach MAR. Its enforcement uses analytical techniques to reduce the initial ill-posed Fredholm integral equation to a well-conditioned infinite system of linear algebraic equations of the second kind. This system was then solved numerically by a truncation method.

The approach was validated by comparison against known results obtained for canonical geometrical structures using benchmark solutions found using separation of variables technique. The obtained solution allows to perform the accurate calculation of complex eigenvalues spectrum, which is not limited nor by geometrical parameters of doubly-connected shells nor by frequency range, which is one of directions for further research.

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**ШЛЯХИ ВИРІШЕННЯ ПИТАНЬ ПРАЦЕВЛАШТУВАННЯ
ВИПУСКНИКІВ ДОРОЖНЬОЇ ГАЛУЗІ**

Моніторинг вимог ринку праці до вмінь випускників вищих навчальних закладів показує, що в умовах ринкової