Abstracts of MMA2015, May 26–29, 2015, Sigulda, Latvia

ON THREE-DIMENSIONAL ELASTIC WAVE PROPAGATION THROUGH A DOUBLY-PERIODIC SYSTEM OF CRACKS

MEZHLUM SUMBATYAN, MICHAEL REMIZOV

Institute of Mathematics, Mechanics and Computer Science, Southern Federal University

Milchakova Street 8a, Rostov-on-Don, 344090, Russia

E-mail: sumbat@math.rsu.ru, remizov72@mail.ru

The study of the phenomenon of reflection of waves propagating in an elastic medium that contains an ordered system of cracks is an important issue for practical application in mechanics, electromagnetism, acoustics [1–3].

From two directions in the study of solids with defects the first is based on a random distribution. There is quite a large number of publications and currently illuminated a wide range of tasks.

In the second direction, the distribution of defects is regular. Doubly-periodic system of cracks was examined in several works, among which there are solutions like anti-plane problems [4, 5] and in the plane setting [6, 7].

In acoustics, signal flow through a doubly-periodic grating, there are many of works to address both planar and spatial tasks [8, 9].

While in theory of elasticity such systems is investigated only for anti-plane and plane problems. Therefore, in this paper we continue the development of the second direction for doubly-periodic system of cracks located in a plane orthogonal to the direction of the incident wave in three-dimensional formulation.

In terms of low-frequency mode, the problem is reduced to two-dimensional hypersingular integral equation for a function of the crack opening in the direction of the incident wave. Further, the use of auxiliary integral equations that do not depend on the frequency of oscillations, leads to an explicit analytical representation of the coefficients of reflection and refraction.

REFERENCES

[1] K. Aki and P.G. Richards. *Quantitative Seismology. Theory and Methods*. Freeman, San Francosco, 1980.

[2] D.S. Jones. *Acoustic and Electromagnetic Waves*. Clarendon Press, Oxford, 1986.

[3] J. Krautkramer and H. Krautkramer. *Ultrasonic Testing of Materials*. Springer-Verlag, New-York, 1983.

[4] E. Scarpetta and M.A. Sumbatyan. On wave propagation in elastic solids with a doubly periodic array of cracks. *Wave Motion*, (25):61–72, 1997.

[5] J.D. Achenbach and Z.L. Li. Propagation of horizontally polarized transverse waves in a solid with a periodic distribution of cracks. *Wave Motion*, (8):371–379, 1986.

[6] E. Scarpetta. In-plane problem for wave propagation through elastic solids with a periodic array of cracks. *Acta Mechanica*, (154):179–187, 2002.

[7] Y.C. Angel and J.D. Achenbach. Harmonic waves in an elastic solid containing a doubly periodic array of cracks. *Wave Motion*, (9):377–385, 1987.

[8] M.A. Sumbatyan. Low frequency penetration of acoustic waves a periodic arbitrary-shaped grating: the three-dimensional problem. *Wave Motion*, (22):133–144, 1995.

[9] E. Scarpetta and V. Tibullo. Explicit results for scattering parameters in three-dimensional wave propagation through a doubly periodic system of arbitrary openings. *Acta Mechanica*, (185):1–9, 2006.