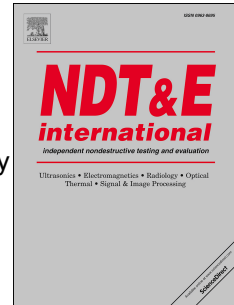


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A spectral analysis of ground-penetrating radar data for the assessment of the railway ballast geometric properties

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1 **A spectral analysis of ground-penetrating radar data for the assessment of the railway ballast**  
2 **geometric properties**

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11

12 **Abstract**

13 This paper presents a methodology for the assessment of railway ballast using ground-penetrating radar  
14 (GPR – 2 GHz horn antenna). The primary approach in this endeavour was the finite-difference time-domain  
15 (FDTD) simulations of ballast (a multi-stage process in terms of ballast size). To this effect, a combination  
16 of random-sequential adsorption (RSA) and FDTD algorithms were applied. The results of the numerical  
17 simulation then were used to compare with the experimental investigations results using a container  
18 (methacrylate material) of the 1.5×1.5×0.5m dimensions. Finally, the modelling of the frequency spectrum  
19 peak and the equivalent diameter of the ballast aggregates was developed.

20

21 **Keywords:** ground-penetrating radar; GPR; railway ballast; grain size; frequency spectral domain; finite-  
22 difference time-domain (FDTD) simulation; random-sequential adsorption (RSA) paradigm

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