

Wojskowy Instytut Łączności - Państwowy Instytut Badawczy

<https://www.wil.waw.pl/wil/publikacje/baza-publicacji/r7447518,Evaluation-of-the-effectiveness-of-protecting-3D-printers-against-acoustic-infil.html>
10.08.2024, 12:08

Evaluation of the effectiveness of protecting 3D printers against acoustic infiltration

Tytuł

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Typ publikacji

[Artykuł](#)

Rok

2023

Data dokładna

2023

Autorzy słownie

Autorzy

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ISBN/ISSN

ISSN 2079-9292

Informacje dodatkowe

Electronics 2023, 12(22), 4641;

<https://doi.org/10.3390/electronics12224641>

Abstract: Three-dimensional printers are increasingly used in design work when designers want to quickly and inexpensively verify their solutions. However, based on the sounds made by the printer during its operation, it is possible to determine the shape of the printed object with quite high accuracy. The above fact should be taken into account if information about this object needs to be

protected. The article presents a way to protect a 3D (Three-Dimensional) printer against acoustic infiltration. The research study was carried out using the Zortrax M200 Plus printer for LPD (Layer Plastic Deposition) technology, which is an equivalent of the popular FDM/FFF (Fused Deposition Modeling/Fused Filament Fabrication) 3D printing technology using thermoplastic. The frequencies of acoustic signals related to the operation of stepper motors and the printing platform were identified. These signals enable the reconstruction of the shape of printed objects. It was examined whether the appropriate type and required level of masking noise can be selected for a given type of printer in order to protect it against acoustic infiltration. The masking properties of selected color noises were compared with those of white noise and the optimal intensity levels were determined at which the acoustic safety of the tested printer can be ensured. It was underlined that the research results refer only to the tested printer and should not be generalized to other types of 3D printers.

Keywords:

3D printer; additive manufacturing; acoustic signal; infiltration; color noise; data acquisition; spectrogram

Powiązane publikacje

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Adres url strony

<https://doi.org/10.3390/electronics12224641>

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