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The possibility to recreate the shapes of objects on the basis of printer vibration in the additive printing process

Tytuł

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Abstract: Information protection is an important safety issue in many human activity fields. Technological advances and related ubiquitous computerization bring new challenges in this area. In particular, the

problem concerns the protection of devices against non-invasive acquisition processed information in ICT systems. It is known that, e.g., VGA, DVI/HDMI interfaces or laser printer formatter systems that process visual signals are the effective sources of compromising electromagnetic emanations. The emission safety of the more and more commonly used 3D printers is less known. In many cases, the disclosure of information about printed objects might constitute an infringement of the state/industrial/commercial secret, copyright, patent protection, etc. In order to analyze the existing threat, a selected printer using FDM technology was tested. During the tests, simple objects were printed to identify the operation of the stepper motor and the movements of the printer head and the printer platform, which are sources of emissions in the secondary channels. The analyses performed focused on finding the correlation between the recorded vibration signals and the printer head movements when an object was printed. It was shown that the analysis of the registered sensitive signal runtimes and their spectrograms allowed to recreate the printed object shape. Three simple objects (a trihedron, a tube and a tetrahedron) were selected for testing because they include elements that allow the four major movements of the printer head to be easily recognized: along the X axis, along the Y axis, along an arc and diagonally (between the X and Y axes). The paper presents the test results and their analyses.

Keywords: protection of information, electromagnetic infiltration, vibration infiltrations, 3D printer, data acquisition, recreating the shape of an object.

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