

Summary of PhD thesis

The dissertation proposes a new approach to the quality control of printing products. Hyperspectral imaging techniques supported by a chemometric approach will undoubtedly allow for the development of non-invasive surface quality control methods based on multi-aspect analysis of spectral data. Hyperspectral imaging allows for recording spectra in the UV-VIS-NIR ranges, depending on the sensors used. The research conducted as part of the doctoral thesis focused on the VIS range. However, the potential of the UV and NIR ranges remains interesting for selected research materials. Research samples taken from the broadly understood spectrum of printing products are a vast variety of printing substrates, types of graphic inks, finishes, and refinements; therefore, due to the implementation and practical nature of the doctoral thesis, samples of multi-color prints printed using the offset printing technique were selected for research. The universal and innovative nature of the proposed approach will allow for adapting solutions to other printing techniques and the possibility of scaling for the needs of different products, not only printing.

The samples were analyzed to compare the image with the reference and to assess and control the stability of the printing process. For both of these aspects, the usefulness of chemometric approaches for innovative monitoring of the quality indicator, which is color, was confirmed. Direct analysis of spectral spectra can be an alternative to quality monitoring in addition to known and commonly used color models. Additionally, imaging the graphic surface and not only the previously designed test fields allows for selecting representative fragments of the sample based on the initial analysis of the recorded image.

The implementation and research work carried out as part of the doctorate were complementary, and the central element of assessing the new quality control method was the possibility of conducting a practical analysis in an acceptable time while maintaining cost discipline. The quality control station was implemented at Walstead Kraków Sp. z o.o. was prepared in a configuration adapted to the specificity of the analyzed products, and the system's performance to the requirements of an industrial scale. The assumptions for the software prototype I defined are being tested on real samples in the company's industrial environment, and will continue to be improved and developed. The proposed, innovative approach undoubtedly has the potential to change the effectiveness of quality control in printing.