Application of vision methods for the identification of spatial objects

Abstract

The study discusses the possibility of utilizing digital image processing techniques for the purpose of initial, semi-automated spatial object diagnostics on the example of electrical power line latticework. The study involved an analysis of literature related to diagnostics, which encompassed the subject matter associated with the identification of objects and detection methods of specific properties of the studied object on digital images. It describes the principles of conducting electrical power line diagnostics and discusses their strengths and weaknesses. The study presents methods most frequently described in literature and their modifications and implementations utilized for the purpose of the author's developed proprietary method.

Further, it presents the author's developed method of virtual photographs as a tool to support the work of technicians in the process of analyzing the photographic material collected during annual areal inspections of the lines. Additionally, the study discusses individual stages of the developed method and their software implementations. The primary objective of the virtual photograph method is to limit the number of analyzed photographs by qualified personnel to only those photographs which indicate the potential risk of inconsistencies with the model - lack of an element or deformation. This method incorporates mechanisms drawn from screening analysis.

In order to achieve a correctly working method, the study describes the adopted principles of photograph evaluation, incorporates a series of analyses regarding the correct determination of irregularities in the latticework structure. During tests photographs of a column printed in a 3D printer were used - these photographs have been taken in strictly specified laboratory conditions, in addition to photographs of the actual object. The resulting principles of evaluating the object's condition, developed based on an analysis conducted in laboratory conditions, also apply to the photographic material taken in the field.

The study also presents an analysis of the developed method's results for different types of photographs, when modifying the values of specific variables which affected the achieved results. The final section of the study presents proposed values of variables which should be used in the method calibration process for different photograph sets.

The conclusion of the study consists of a summary, containing the author's conclusions regarding the possibilities and limitations associated with utilizing the developed method. It also presents the directions of further research in terms of functional development of the method and potential new applications.