

DIGITAL IMAGE CORRELATION AS DISPLACEMENT AND DEFORMATION MEASURING TOOL, USAGE EXAMPLES

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Abstract

Digital Image Correlation is a state-of-the-art technique for experimental measurement of displacement, strain and indirectly stress of constructions. Aramis software is developed by GOM based on Digital Image Correlation and implemented in the system for non-contact optical measurement. Beside the software, the system includes stereo cameras and lenses. To use the Aramis system, the first requirement is that the surface is prepared for filming. Preparation of the surface implies that stochastic pattern is applied to the surface of the object to be deformed (irregular black dots on a white background), because the system compares the position of points (pixels) before and after loading and deforming the object. The second requirement is that the system is calibrated. Both of these requirements don't require a lot money and time (comparing to some other methods).

For instance, measurement of construction strain by the method of strain gauges implies positioning of strain gauges at previously selected critical places, in zones of stress (and strain) concentration. As a problem with the method of strain gauges, which is most often used for diagnostics, the positioning of gauge itself is imposed. The gauge should be placed in zones where there is a large stress change gradient, so the strain gauge position affects the results a lot. This problem is overcome by using the Aramis system, which enables the recording of strain over the entire field. So, in the actual



stress concentration zone virtual strain gauge can be positioned, which measures the distance between two points before and after the loading.

The first several measurements using the Aramis system (in this research) were performed by measuring objects using the Aramis system and the strain gauges in parallel. The objects of observation in those experiments vary from pipe branches to bucket wheel excavator parts (there are no limitations in terms of the type and material of the object, although steel structures were mainly examined). In the way of measuring objects using the Aramis system and the strain gauges in parallel, the Aramis system is calibrated and could be trusted completely in the future. Later, it was used when other measurement tools couldn't, for instance, when the zone of stress concentration is too small to position a strain gauge, as in stress concentration zone on the locking compression plates (a hole diameter is less than 4 mm, stress concentration zone less than 2 mm). It was also used to record a crack growth, and strain in zones near the crack.

Keywords

Digital Image Correlation, stress and strain measurement, steel structures

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