Determining fracture mechanics parameters using the digital image correlation method on cylindrical samples produced by different additive manufacturing techniques

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ABSTRACT

This work presents the difference in the values of fracture mechanics parameters obtained by testing of cylindrical specimens with a sharp notch, cut on the tip of a wider groove. The samples were obtained using two different additive manufacturing techniques. The first type of samples was obtained by the FDM (Fused Deposition Modeling) method, on the German REPRAP X400 device with an average accuracy of 0.25 mm. The second type of samples was made using the SLS (Selective Laser Sintering) method on the EOS Formiga P100 device with a production precision of 0.08 mm. Regardless of the difference in manufacturing techniques, the direction and orientation of the samples was identical. The samples were prepared so that during loading the fibers are loaded in tension, i.e. axially. Different lengths of the sharp notches were fabricated axially on the samples. The values of fracture mechanics parameters such as CMOD (Crack Mouth Opening Displacement) and CTOD-δ_5 (Crack Tip Opening Displacement obtained using the -δ_5 technique) were obtained using the digital image correlation method. The obtained parameters, except for mutual correlation, were also used for the verification of numerical results. In the future work, a procedure for determination of energy-based fracture mechanics parameters will be developed for this sample geometry.

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