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High-Precision Visual Servoing for the Neutron Diffractometer STRESS-SPEC at FRM II

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The Heinz Maier-Leibnitz Zentrum (MLZ) operates at Germany's sole neutron source FRM II the diffractometer STRESS-SPEC optimised for fast strain mapping and texture analyses. The STRESS-SPEC group was the first to pioneer sample handling and positioning via industrial robots at neutron diffractometers [1, 2]. However, the current robot is limited in its use due to insufficient absolute positioning accuracy of up to ± 0.5 mm in some cases. Usually, an absolute positioning accuracy of 10% of the smallest gauge volume size –which in case of modern neutron diffractometers is in the order of 1×1×1 mm3 –is necessary to allow accurate strain tensor determination and correct centering of local texture measurements. The original robot setup at the neutron diffractometer STRESS-SPEC has therefore been upgraded to a high accuracy positioning/metrology system. We will give a short introduction on the complete measurement process chain for the new robot environment. To achieve a spatial accuracy of 50 µm or better during measurement of the full strain tensor, the sample position is tracked by an optical metrology system and actively corrected, which we will show in detail.

[1] H.-G. Brokmeier et al., Mater. Sci. For. 652 (2010) pp. 197–201.
[2] C. Randau et al., Nucl. Instr. Meth. A: 794 (2015) pp. 67–75.

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