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High accuracy positioning with an industrial robot system for neutron residual stress and textre analyses at STRESS-SPEC

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STRESS-SPEC was one of the first neutron diffractometers at which industrial robots for sample handling and positioning were used. However, industrial robots are still limited in their use due to insufficient absolute positioning accuracies 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.

Two new designed radial collimators create more space in the sample environment and enhance the residual stress analysis capabilities for large complex parts. In addition, a newly designed laser furnace can be mounted at the robot flange to conduct, for example, texture measurements at elevated temperatures of up to 1300 ℃. A brief overview of the STRESS-SPEC instrument and its capabilities using the new robot setup will be given.

Primary authors: Mr LANDESBERGER, Martin (TUM);   WANG, Lijiu;   HOFMANN, Michael;   KRUEGER, Jens;   Mr KEDILIOGLU, Oguz (FAPS);   GAN, Weimin (Helmholtz-Zentrum Hereon)

Presenter: WANG, Lijiu

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