

Biax Tester for Elastomer Materials

- Adaptive Control for cyclic processes in multiaxial systems (AREM)
- Electromechanical dynamic load systems
- Measurement of strain and force
- Optimal force-distribution through moving sample-fixture



Biax Tester

The testing system contains 4 electromechanical drives. Each drive is equipped with a travel and force sensor. Fig. 1 shows a sketch of the machine. Each drive can run an individual motion profile. The user can choose from standard profiles (e. g. sine, pulse, rectangle, triangle or up-load of an individual load spectrum).

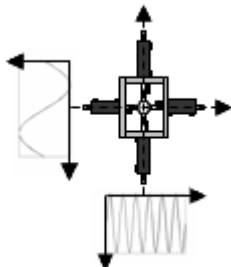


Fig. 1: Sketch of test system with individual profile on each axis.

The mechanical setting in combination with a new sample-fixture assures that forces are properly passed to the sample. Fig. 2 shows a picture of the sample-fixture. The entire width of the sample is clamped with moveable fixtures. The sample-fixture holds elastomer samples of 100x100 mm². Strain can be applied up to 30 % of the specimen's width. The motion profiles can contain frequencies up to 50 Hz and it is possible to apply forces of up to 1 kN.

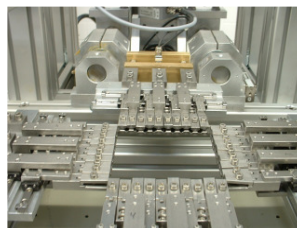


Fig. 2: Moveable Sample-Fixture.

Adaptive Control (AREM)

Coesfeld has developed an adaptive controller for cyclic processes in cooperation with the Technical University of Darmstadt, Laboratory of Control Engineering and Mechatronics. The Controller automatically adapts to the controlled system without any additional user-input. That way, an optimal mapping of measured actual motion profile and the desired motion profile is achieved.

The development of the new controller includes the applicability to single-input single-output systems as well as the applicability to multi-input multi-output systems as the Biax Tester. The adaptation to coupled multi-input multi-output systems is a unique feature of AREM. Just as it is the case for

for uniaxial systems AREM adapts to coupled multi-input multi-output systems automatically and reaches a very good match of actual and desired profile after only a few cycles. AREM remains active throughout the entire measuring process. Thus, fatigue of the material will be compensated throughout the measurement.

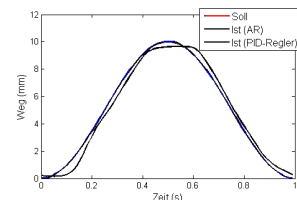


Fig. 3: Comparison of a manually optimized PID-Control with the adaptive Controller (AR) after the 10th iteration. The desired and actual profile show a very good match with AR. The PID-Controller shows a contouring error and the stick-slip behaviour of the system.

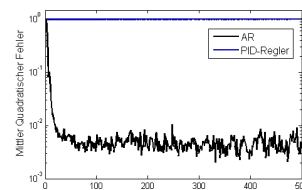


Fig. 4: Development of the Mean Squared Error from cycle to cycle. AR reaches a betterment compared to the PID of a factor greater 100 after about 20 cycles. The remaining error is smaller than 50 micrometers.

The Biax Tester with AREM is a perfect tool for material parameterisation, fracture mechanical analysis and the investigation of tear growth resistance and tear propagation for elastomers under biaxial exposure. Thus, with the Biax Tester a dynamic material testing machine is available that provides unique testing scenarios.

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