

LABA7 Explores the Next Generation of Shock Absorber Testing, From Crank Dynos to Electromagnetic Technology

On EPARTRADE's Race Industry Now, LABA7 demonstrated how programmable motion, high-resolution data acquisition and integrated software can help engineers investigate damper behavior beyond conventional force curves.

Shock absorber testing provides essential information for suspension tuning, quality control and product development. But the motion used to test a damper determines what engineers can learn from the results.

That principle was central to EPARTRADE's Race Industry Now Episode 639, "Shock Absorber Testing: From Crank Dynos to Electromagnetic Technology," featuring Andrius Liškus, CEO & Head of R&D, LABA7, and Andrius Petkauskas, Co-Founder & Head of Software, LABA7. Hosted by Brad Gillie from SiriusXM, Ch. 90, Late Shift, the session examined the capabilities of conventional crank dynos, servo-hydraulic systems and electromagnetic testing machines, supported by a detailed software demonstration.

"The dyno only tells you what the damper did in the motion that you gave to it," Liškus explained.

For race teams, damper manufacturers and suspension specialists, the implication is significant: a repeatable sinusoidal test can characterize a shock absorber under defined conditions, while more complex inputs can expose behavior that requires further investigation.

Understanding the Limits of Conventional Crank Dynos

Based in Vilnius, Lithuania, LABA7 designs and manufactures shock absorber dynos and other testing equipment for customers ranging from damper service shops and racing organizations to OEMs and specialist manufacturers.

Liškus began with the Scotch yoke mechanism used in conventional crank dynos. A motor rotates a crank, and the mechanism converts that rotation into linear motion. At constant rotational speed, the resulting displacement follows a sinusoidal waveform.

The design offers simplicity, durability and affordability. It is well suited to checking damper condition, matching shocks, comparing adjustments and monitoring changes over a damper's service life.

Its limitations come from the same mechanical arrangement. Stroke is adjusted manually, and the relationship between stroke, frequency and peak velocity is constrained by the mechanism. At a given stroke, increasing frequency also increases peak velocity.

Consequently, a conventional Scotch yoke dyno cannot independently reproduce arbitrary motion profiles such as constant-velocity ramps, isolated impacts or recorded suspension

movement from a racetrack. Liškus also noted that mechanical components in the drive system can introduce artifacts into the measurement.

For routine verification, these tradeoffs can be acceptable. For development work focused on transient events or specific operating conditions, the test input becomes a more substantial consideration.

Electromagnetic Testing Expands the Available Inputs

Servo-hydraulic machines provide programmable motion and high force capability, making them suitable for more advanced testing. Liškus discussed the associated maintenance requirements and the control tuning that may be needed for different dampers.

LABA7's electromagnetic machines, or EMAs, use a direct-drive actuator to apply motion to the damper. According to Liškus, this architecture allows engineers to generate sinusoidal, triangular and constant-velocity profiles, as well as reproduce recorded road or track inputs within the machine's operating capabilities.

That flexibility supports investigation of individual events, including curb strikes, pothole impacts and landings after jumps.

True constant-velocity segments are particularly useful because they allow engineers to examine force behavior while maintaining a controlled piston speed. Very slow movement provides another diagnostic tool: Liškus said LABA7's EMA machines can operate at 0.1 millimeter per second or lower, enabling investigation of friction, breakaway behavior and gas-force contributions.

LABA7 develops its own controller, with an emphasis on accurate velocity tracking. As Liškus explained, interpreting force measurements depends on knowing that the machine delivered the intended motion.

Repeatable Testing Starts With Temperature Control

Petkauskas demonstrated how LABA7's software supports both conventional dynos and electromagnetic machines through a common interface.

For routine testing, operators can build automated sequences that warm a damper to a specified temperature before running a series of speed tests. In the demonstration, he configured a warm-up target of 35°C before adding test intervals.

Temperature control is essential when comparing dampers or adjustments because damper force varies with operating temperature. A cold test and a hot test may produce different results even when the hardware configuration is unchanged.

The software displays force versus displacement, force versus velocity and peak-force values at the peak velocities of successive runs. Operators can also examine individual channels and compare results.

For production and service applications, a pass/fail function compares measured performance against predefined acceptance ranges. Petkauskas demonstrated how a change in rebound settings could move a damper outside those ranges, producing a clear fail indication.

Using the same software across machine types also allows engineers to compare routine quality-control results with subsequent development tests.

Frequency Sweeps and Track Replay Reveal More Detail

For more advanced analysis, Petkauskas demonstrated a frequency sweep configured for a 20-second test, a 20-millimeter stroke and a frequency range from 1 to 20 Hz.

With displacement held constant, increasing frequency also increases velocity. Examining the resulting force and displacement data revealed irregularities near the beginning of rebound.

Such features can guide further investigation into possible causes, including aeration, valve behavior or shim stiction. The plots establish where an irregularity occurs; identifying its physical cause may require additional testing.

The software also allows users to import, trim and replay recorded track data. Petkauskas showed how a roughly 10-minute recording could be reduced to a 20- to 30-second segment containing the event of interest.

This gives engineers a repeatable way to investigate a particular curb strike, corner sequence or suspected damper issue without replaying the entire recording.

When recorded data is unavailable, the software can generate alternative inputs, including pink noise. The demonstrated profile combined larger movements at lower frequencies with smaller movements at higher frequencies, providing a repeatable excitation for development work.

By inspecting synchronized force, velocity and displacement channels, engineers can locate an irregularity and determine the operating conditions under which it appeared.

Sampling Rate and Filtering Can Change What Engineers See

One of the session's most instructive demonstrations addressed the difference between a clean-looking graph and a graph that preserves useful diagnostic information.

Petkauskas said LABA7's Scotch yoke dynos sample at 2 kHz, while its EMA machines provide a native 20 kHz sampling rate. The higher sampling rate provides finer time resolution for examining short-duration features in the measured signals.

The software exposes raw data and gives users control over filtering. During the demonstration, a 2,000 Hz low-pass filter reduced noise while leaving the observed irregularities visible. Applying a 500 Hz filter removed those features from parts of the higher-speed data, producing a smoother curve.

The example illustrated how filtering can conceal behavior that an engineer is trying to investigate.

Petkauskas also presented results from a Formula 1 damper that appeared to perform normally at test velocities up to approximately 20 inches per second. At 30 inches per second, the force curves developed irregularities. Potential explanations discussed included bypass behavior, cavitation or another operating limit, rather than a confirmed diagnosis from the graph alone.

Additional Sensors Support Deeper Investigation

During the audience Q&A, Liškus explained that modern dyno testing can reveal signatures associated with cavitation, gas and oil mixing, seal friction and stiction.

Direct measurement of internal pressure requires additional instrumentation. LABA7 offers data-acquisition options for external sensors, allowing pressure, oil temperature, vibration and other signals to be recorded and compared with the dyno data.

Liškus also described a recently tested side-load system, developed to investigate how lateral loading affects damper behavior.

On the relationship between physical testing and numerical modeling, he said LABA7 is supporting companies that develop simulation tools by helping validate models against measured damper performance. He also discussed hardware-in-the-loop applications and comparisons between physical test results and mathematical models.

High-Velocity and Endurance Systems in Development

Liškus previewed forthcoming high-velocity EMA equipment targeting test speeds of 10 meters per second and force capability above 70 kN. These were presented as development targets, rather than a statement that maximum speed and maximum force would be available simultaneously.

Intended applications include motorcycle and bicycle forks, long-travel side-by-side dampers and trophy truck suspension.

LABA7 is also developing liquid-cooled machines for fatigue testing over millions or tens of millions of cycles, with the goal of supporting extended continuous operation.

For users who need portable equipment, Liškus highlighted the Micro Dyno, weighing approximately 65 kilograms and operating on single-phase power. Suitability for motocross or mountain bike forks depends on the required test specifications.

He also explained that LABA7 uses supercapacitor technology in its EMA systems to store energy and supply power during testing, supporting installations in trucks or larger trailers without drawing all instantaneous power directly from the electrical supply.

Connecting Hardware, Software and Engineering Workflows

LABA7 develops its mechanics, electronics, controllers and software in-house. Petkauskas said this allows the company to respond quickly to customer requirements and add features based on practical testing needs.

The software supports metric and imperial units, multiple languages, CSV export and reporting. A MATLAB library also allows users to open LABA7 data files for analysis in their own engineering environment.

Throughout the session, the emphasis remained on connecting the test input to the engineering question. Whether verifying a rebuilt shock, matching a set of dampers or investigating an irregularity under a recorded track event, useful results depend on controlled motion, consistent conditions and sufficient measurement detail.

For more information, [watch the full webinar here.](#)