ETAS

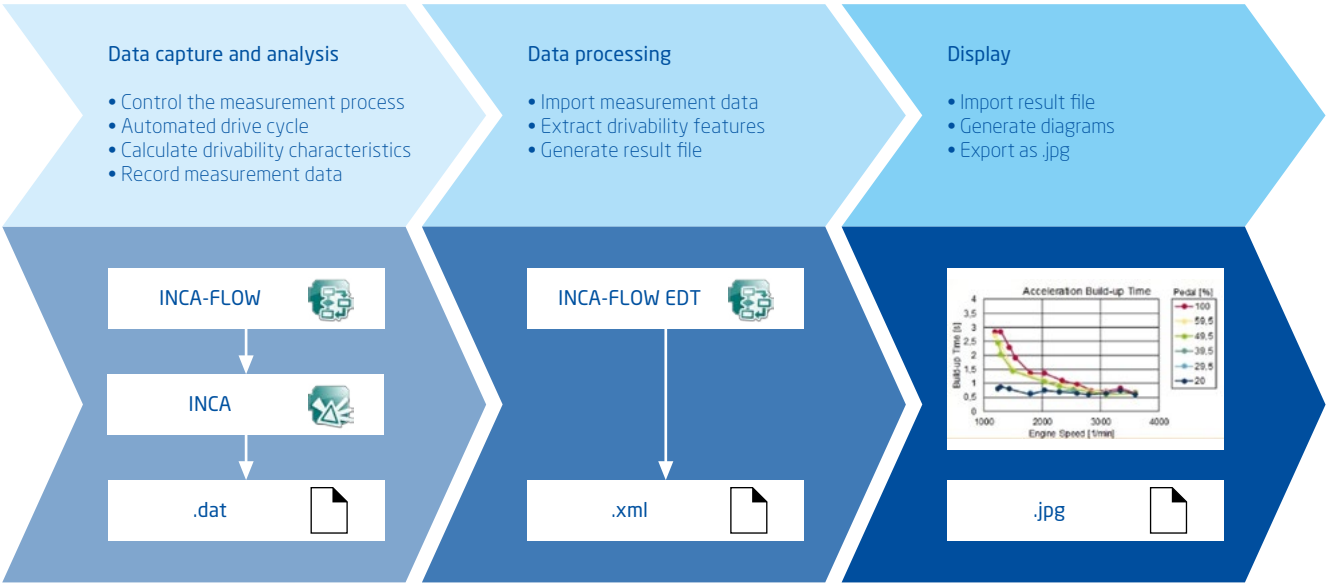
DRIVING EMBEDDED EXCELLENCE

Translated article "Mess- und Bewertungssystem – Gemessene Erfahrung," HANSER automotive 5 / 2019

A measure of experience

Measurement and evaluation system for achieving desired levels of drivability

When people buy a car, they expect to get a carefully tuned driving experience that corresponds to their chosen brand. The problem is that test vehicles do not become available until late in the development process – and even then their numbers are strictly limited. As a result, calibration engineers often have to work under intense time pressure to tune the driving behavior of numerous different vehicle variants and models. Currently, they rely on their expertise and gut instincts to carry out this tuning process. But now ETAS, in collaboration with IAV, has developed a measurement and evaluation system based on INCA-FLOW that allows engineers to tune even large numbers of vehicles with remarkable efficiency.



EDT toolchain – from the performance of driving maneuvers to the capture and analysis of measurement data and the presentation of results

It was certainly a daunting task: Carmakers were increasingly calling for a system that would simplify vehicle tuning in the calibration process while simultaneously enabling them to efficiently define the character of the vehicle itself. What's more, they wanted to create objective descriptions of calibration criteria that engineers had previously determined subjectively. But why were their calls for action steadily becoming more urgent?

Complexity is constantly increasing, and so too are the challenges it creates. The variety of vehicles car manufacturers offer is growing inexorably, with ever more nuanced differences between vehicle variants. As well as multiple different models, there is also a multitude of powertrain configurations to consider, with hybrid concepts that offer different operating modes and types of transmission. These include manual transmissions and torque converter automatic transmissions as well as automated manual transmissions, dual clutch transmissions, and continuously variable transmissions. The automotive industry is also facing ever stricter emissions standards in real-life driving conditions for combustion engines (RDE, real driving emissions) while simultaneously striving to reduce CO2 emissions in the strict WLTP cycle (Worldwide harmonized Light vehicles Test Procedure). Yet none of these requirements can be allowed to have a negative impact on drivability.

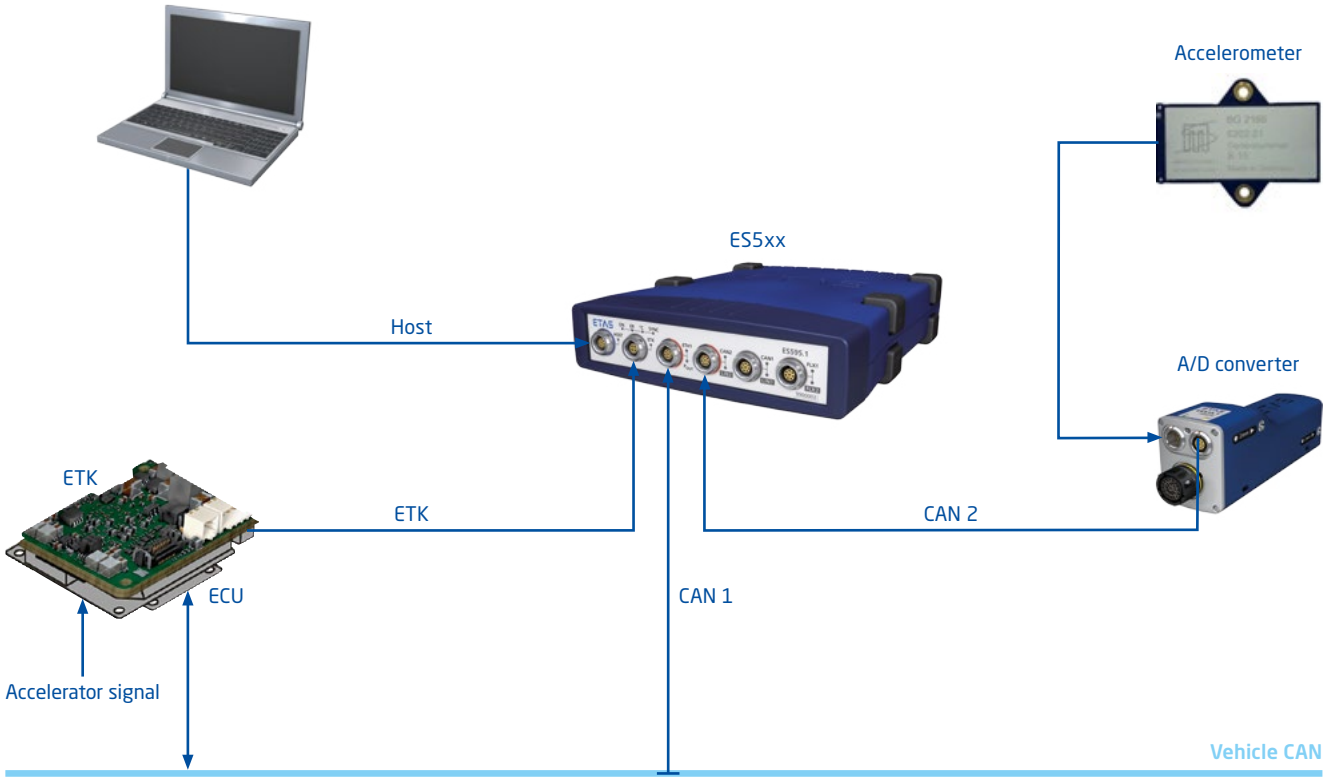
On top of all these challenges, many end customers expect their chosen vehicle to offer a driving experience that meets their own individual needs, and they would ideally like to be able to finetune this experience as they see fit. For example, the driver of a luxury sedan may be looking for smooth and poised acceleration, while the driver of a sports car may prefer a more immediate response. There are also likely to be noticeable differences in the start-up and gear change characteristics. Each car model has its own character, and vehicle models may differ substantially from each other even within the same brand.

Calibration engineers are faced with the task of tuning each type of vehicle in line with the technical data specified for that model while simultaneously creating the desired level of drivability. Each vehicle's individual character largely stems from the driving behavior exhibited during forward motion, which is heavily dependent on the powertrain. Engineers have traditionally used a number of tools to tune the driving experience, but their subjective perception has also played a major role.

Simplified calibration

In collaboration with IAV, ETAS has now developed an objective measurement and evaluation system that meets the auto industry's needs: the INCA-FLOW drivability toolboxes for the engine (EDT) and transmission (TDT). These toolboxes make calibration engineers' work considerably easier. The software tools are easy to use and fully integrated in the existing ETAS calibration toolchain. It takes just a few minutes for the toolboxes to gain access to the existing ETAS measurement hardware in the vehicle, for example, from the ES500 series. Instead of requiring their own sensors, the toolboxes simply read vehicle signals from existing bus systems such as CAN, FlexRay, and XCP. Engineers also have the option of using an external accelerometer that takes just a few moments to install on a seat rail.

The process itself is simple: As the vehicle goes through its various driving maneuvers, the measurement and evaluation sy-



Configuration of the measurement system.

stem records the physical parameters of the powertrain in real time. As a rule, the acceleration and speed signals are the best choice for providing reliable evaluation parameters for load changes, pedal modulation, gearshift sequences and start-up. The system evaluates this measurement data and displays the relevant drivability parameters as both numerical and graphical outputs, including comparisons with reference values. The system also provides the option of offline evaluation – for example with colleagues back in the office.

Rapid calibration chain

The relevant drivability parameters for forward motion can be changed even while a calibration test drive is in progress. The INCA-FLOW EDT and TDT toolboxes themselves determine the criteria (e. g., "jolting") based on objective rules and display them directly in the INCA experiment. That enables calibration engineers to shift the driving characteristics in the required direction quickly and efficiently.

The measurement and evaluation system really shows its strengths in situations where calibration targets are agreed with binding effect as acceptance criteria in the form of target parameters right at the start of the project. Engineers can then specifically measure these parameters during the calibration test drive and steadily optimize them to achieve the desired result.

In conclusion, the INCA-FLOW EDT and the Transmission DrivabilityToolbox TDT are remarkably powerful tools for efficient vehicle tuning. One of their key benefits is the ability to replace calibration criteria that were previously determined on a subjective basis with objectively measured values. That makes the tuning process simpler and faster and makes it easier to draw comparisons. As a result, the system provides a successful method of delivering desired driving characteristics for numerous variants and models within short timeframes and with limited test vehicles.

Authors

Uwe Heyder is Specialist in engine drivability at IAV GmbH in Berlin, Germany.

Dr. Felix Matthies is Specialist in transmission drivability at IAV GmbH in Braunschweig, Germany.

Rajesh Reddy is Product Manager for INCA-FLOW at ETAS GmbH.