

Save time during endurance testing

Mobile and automated acquisition and analysis of vehicle vibrations



Fig. 1: Israeli AIL all-terrain vehicle.

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The geography of Israel is characterized by coastal regions, but also by desert and hilly landscapes that account for more than 50% of its territory. Vehicles that are used here off-road are exposed to particular stresses. The Israeli imc partner MotionTech Ltd. developed a mobile application with the imc CRONOS*flex* system to measure vehicle vibrations for durability testing. This test is largely automated. Integrated real-time data analysis saves time by pre-selecting and processing the measured data.

Considerable time required for endurance testing under real conditions

Durability tests with the vehicle, which are carried out under real conditions, provide information about the load on vehicle components. For this purpose, the vehicle must be driven for 10 seconds at constant speed on uneven ground, to gain a random profile of the terrain, while the measurement is being carried out. The problem is that the quality of the recorded data could previously only be determined after the test, so that if a test failed, it could only be repeated after the data analysis. Also a lengthy stationary post-processing of the data analysis delayed the progress of the development.

Higher testing efficiency through automation

The primary application goal of the Israeli imc partner MotionTech Ltd. was to improve and simplify the test procedures and test environment. Above all, the time required for the endurance test was to be reduced without sacrificing test accuracy. This was achieved by using the modular DAQ system imc CRONOSflex with the integrated real-time analysis tool imc Online FAMOS and a MS Windows-based Tablet PC with imc Inline FAMOS.

This mobile measurement data acquisition is started via a customer-specific application in imc STUDIO using a tablet by the driver of the test vehicle and runs automatically. The recorded data are analyzed and validated in real time. This way the driver already knows during the test whether sufficient valid data are available or whether the test must be repeated.

System Overview

imc device	Qty.
imc CRONOSflex (CRFX)	1
imc Software	
Imc Online FAMOS Prod Real-time data analysis platform for imc CRONOS devices	
imc Inline FAMOS Pro	
imc STUDIO Developer Comprehensive measurement software for the entire test process: measurement, visualization, automation, data analysis	
Additional device	
Tablet-PC with MS Windows Operating System	



Fig. 2: Tablet positioned within the vehicle ©MotionTech

The measurement

The special aspect of this durability test is that it is not carried out by means of a strain gauge measurement, but by measuring the vibrations on selected (load-bearing) vehicle components. It takes only 10 seconds of coherent data on a similar surface to determine the load on the component by means of a vibration profile. The test is repeated for several speeds and different surfaces, e.g., asphalt, gravel, sand.

The measurement procedure

Before the start of the measurement, the driver enters the ambient variables of the test on the tablet. The software used here is an individually developed imc STUDIO application with graphical user interface. The necessary environmental parameters for the measurement include the terrain, the speed the vehicle should have during the measurement and a measurement tolerance for the speed.

Up to now there was no possibility to set the terrain in the measurement software. Therefore, individual test drives had to be carried out for each terrain. The possibility to select a terrain in the software reduces the number of test vehicles and drivers.

Data acquisition begins automatically after the start of the measurement if the vehicle maintains a constant speed for at least 5 seconds. The speed must now remain constant for 10 seconds. For this purpose, the tablet in the vehicle interior shows the driver the progress during this time period.

Validation of the test data

The measurement data are automatically verified by the imc system in real time. If the deviations from the target speed are too large during the measurement, the system sends a signal via the display to repeat the test run. This is a decisive advantage over the previous

measurement method, where deviations could only be detected during post-processing of the data.

The integrated real-time data analysis in imc Online FAMOS also automatically checks whether the recorded data makes mechanical sense, i.e., whether all sensors are correctly attached or cables have problems or have experienced problems during the test. With the help of an RMS calculation (Root Mean Square), a check is made to determine whether the vibrations have a stationary origin.

imc CRONOSflex

The imc CRONOSflex system is used here to acquire the various measurement data. Its modular design allows spatially distributed measurements. The base module of the DAQ system can be extended with different modules thanks to its click mechanism. The possibilities of the locations of the individual modules as well as the number of measurement channels are therefore scalable and almost unlimited. So the FAMOS algorithm automatically adjusts the number of required channels during the test.

The imc CRONOSflex also integrates the real-time data analysis imc Online FAMOS in addition to the imc Inline FAMOS installed on the Tablet-PC.



Fig. 3: imc CRONOSflex data acquisition system, © imc Test & Measurement GmbH

Real-time data processing with imc Online FAMOS und imc Inline FAMOS

As described above, the integrated real-time data analysis functions of imc Online FAMOS are used to verify the quality of the recorded vibrations already during the endurance test. The calculation functions of imc Online FAMOS can be executed time-synchronously, deterministically and cross-channel. For example, the data acquisition starts automatically when the vehicle drives at a constant speed for at least five seconds. During the measurement, imc Online FAMOS monitors each measurement channel and checks every second whether the collected data are usable. Thus, imc Online FAMOS saves time and money, because a subsequent evaluation is not necessary at all or is considerably shortened.

Graphical user interface and data visualization with imc STUDIO

The progress of the test is directly displayed to the driver on the tablet via the imc STUDIO application. The usable data are processed via imc Inline FAMOS and visualized as a bar chart so that it is clear how much usable measurement data still has to be acquired.



Fig. 4: Tablet with imc STUDIO application in the vehicle
©MotionTech

imc STUDIO is also used for the graphical interpretation of data within a report.

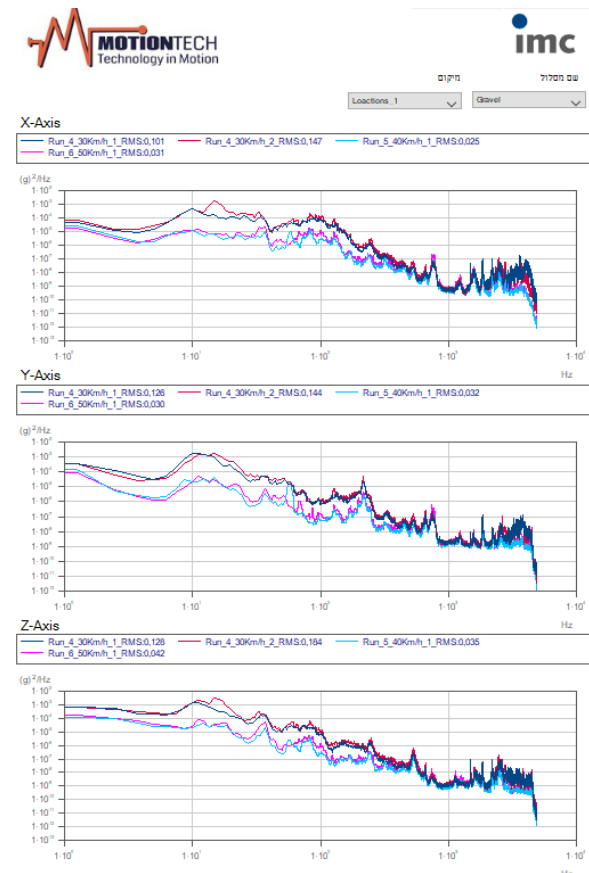


Fig. 5: Measurement data in imc STUDIO
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Conclusion

The solution developed by MotionTech Ltd. offers numerous productive advantages. For example, the use of real-time monitoring and data analysis, together with a graphical user interface, helps save time and avoids unnecessary test drives.

The vehicle fleet can also be reduced by variable selection of test conditions in the software. With the imc system, the test vehicle is no longer bound to one type of terrain, but can complete test drives on a wide variety of sites. The final measurement data report is also generated directly so that the measurement can be evaluated in real time.

Additional information:

imc Test & Measurement GmbH

Voltastr. 5
13355 Berlin, Germany

Telephone: +49 (0)30-46 7090-0
Fax: +49 (0)30-46 31 576
E-mail: hotline@imc-tm.de
Internet: <http://www.imc-tm.com>

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