www.instron.com/ist

Hydropuls®- Crash-Simulation System

Catapult

INSTRON® STRUCTURAL TESTING SYSTEMS

Hydropuls® - Crash - Simulation System

The protection of life and limb of vehicle occupants is one of the prime tasks in motor vehicle development. Next to active safety systems, passive passenger restraint systems are critical elements when it comes to preventing injury and ensuring the safety of vehicle occupants in the case of accidents. In the event of a crash, occupant restraint systems prevent a collision of the occupants with hard components in the vehicle interior such as the dash panel or steering wheel.

The interaction between the airbag and other vehicle components has a critical influence on the level of protection afforded by the airbag. To this end, the properties of the seat belt including belt retractors, steering wheel, headrest, seat cushions and kneepads must be optimally adapted to the airbag system.

The development of new vehicle concepts necessitates the design of a complete new occupant restraint system.
All phases of component development and evaluation of their interaction with other vehicle components are supported by numerical simulation.

Numerical simulation includes the following aspects:

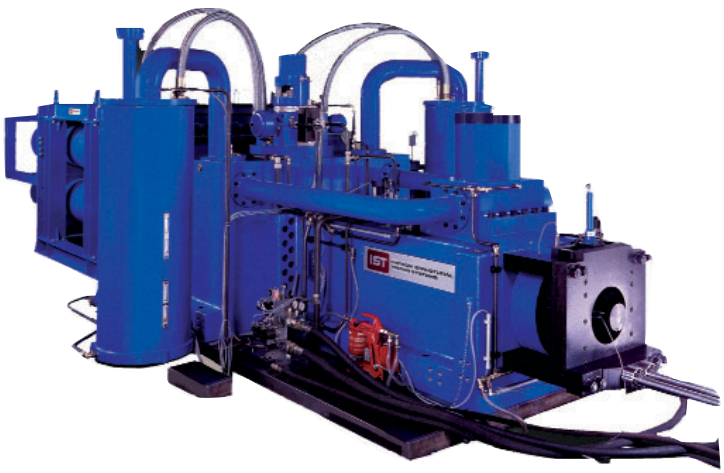
- Crash behavior of mechanical structures
- Simulation of occupant behavior
- Component simulation for optimization of, e.g., gas generator, airbag etc.
- Strength analysis
- Simulation and coordination of electromechanical and electronic sensor systems for crash detection

Numerical simulation significantly reduces the time and cost spent on manufacture and testing of prototypes. The basis for decision making on the necessary measures for coordinating the various system components is broadened and the development process is streamlined.

Following implementation of the simulation results in the development of the prototype, optimum interaction between all components of the restraint system is then tested with the help of vehicle crash tests, tests on a catapult rig and other testing procedures. The Hydropuls® Crash Simulation Rig therefore constitutes an important element in the development of restraint systems and their components.

Areas of Application of the Crash Simulation System:

- Dynamic seat testing to ECE R 17
- Dynamic seat testing to AS 8049 (Aerospace Standard)
- Crash Simulation Tests with dummies in the vehicle body or on a rigid fixture
- Dynamic testing of restraint systems to ECE R 16
- Crash Simulation tests with pyrotechnical restraint systems (belt retractors, airbags)
- Testing of cargo restraint systems to DIN 75410/2
- Child seat testing to ECE R 44
- "Low Speed Rear End Impact" - seat testing
- Test pulses to US and Euro NCAP (New Car Assessment Program)



System Overview

Modular Concept

The Hydropuls® Crash Simulation Rig is designed so that all applications currently available as options (see under Options) can be retrofitted quickly and easily at a later stage. To make sure that this will work without problems, the base plate for the external braking system for side impact testing is already included in the foundation, and pits and anchor bolts for installation of the pitching drive are already provided for in the basic system, to mention only a few examples.

RS CrashSim Software

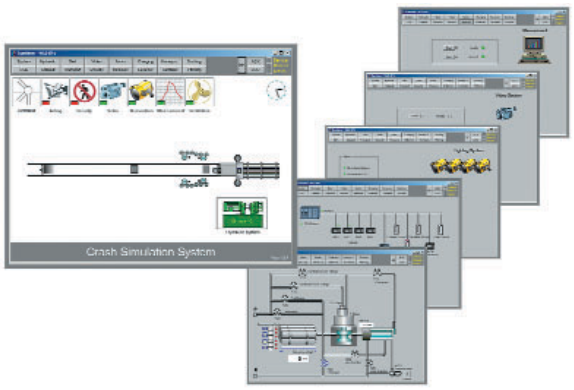
The RS CrashSim simulation software is conceived for drive signal generation, visualization of the test sequence, and presentation of test results and display of the system status. It also serves as interface to the peripheral equipment.

Main features

RS CrashSim is a software module based on the RS LabSite® software suite enabling drive signals for the catapult rig to be calculated and iterated from pre-set acceleration time histories.

Main features of the software module are:

- Direct calculation of drive signals from specified acceleration signals, based on a non-linear, inverse model of the catapult rig.
- Enhanced signal reproduction accuracy through iteration on the basis of measured acceleration signals; display of error convergence
- Monitoring with respect to drive signals exceeding system limits prior to triggering of the shot
- Parameterization of the model and input of specimen properties through a user friendly operating interface
- Visualization of system status through a process master display



Catapult Performance Data

Acceleration force	max. 2,500 kN
Working stroke	max. 1,700 mm
Payload Including test specimen, dummies, fastening elements, data acquisition equipment, cameras, camera stand	max. 2,000 kg
Velocity	max. 90 km/h
Acceleration gradient (typical value)	>10 g/msec
Frequency range	max. 150 Hz
Tolerance on maximum speed	max. +/- 0,5 km/h
Repeatability Acceleration Velocity	(rms value on total signal) ± 1 g ± 0,5 km/h

Labtronic® 8800 Structural Test Controller

The Labtronic 8800 structural test controller is a control system adapted specifically to the requirements of Hydropuls testing systems. It provides a maximum of six control channels for up to four test groups. Sensor signals and command signals are digitally processed. In conjunction with the programmable logic controller, the Labtronic 8800 structural test controller constitutes the central element of the testing system.

Optional Extensions

Sled-on-Sled Test

For these applications, a collision device is mounted on the base sled, accommodating a honeycomb to be provided by the customer, which serves as impactor for the penetration test. Additional masses can be mounted on the sled for making up the desired total mass. This sled is accelerated to the desired speed by the actuator of the catapult rig

A second sled carries the structure-undergoing test and is positioned on the guideway with its brakes applied (with a braking pressure of around 140 bar). The test allows penetration depths (specimen deformation) up to 700 mm. For measurement purposes the test specimen (i.e. the door structure) and the dummy, which is mounted on a seat, are equipped with acceleration sensors.

The velocity of the impacting sled can be chosen at random up to a maximum velocity of 60 km/h.

Multi-Sled Operation

The sled changing station enables convenient changeover from one sled to the next, in applications where multiple sleds are used for a variety of applications.

Side Impact Simulation

The side impact simulation system developed by IST with servo-hydraulically controlled sled brake enables the simulation of the acceleration time histories of side impacts without the sled losing contact with the catapult piston of the catapult actuator.

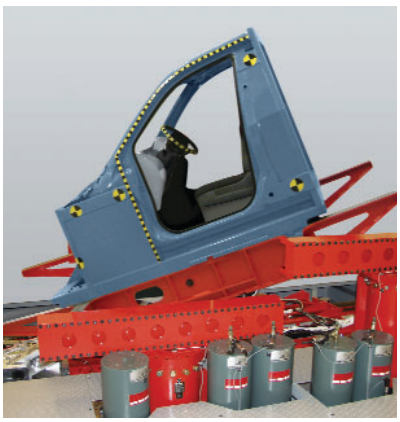
Low Speed Rear End

For this application IST is offering a simulation package enabling highest signal reproduction accuracy, even with low accelerations. On the hydraulics side, a servo block with electrically controlled changeover module is mounted on the driver cylinder of the four-stage servo valve. The servo block carries two-servo valve combinations that are activated automatically depending on the test selected on the test PC (low speed rear, frontal/rear end crash, side impact or pitching test). At the same time all system parameters associated with this test type are loaded.

Pitching

This application simulates the pitching movement of the vehicle during a frontal crash. Up until now, the simulation of overlaid pitching movements of the vehicle during the crash has only been possible in real, destructive crash tests, given that conventional catapult systems, not providing for active, controlled pitching simulation, do not reproduce the damage on the test person (dummy) with sufficient accuracy.

The HIC (Head Injury Criterion) value, for example, is up to 40% higher (depending on vehicle type) on a crash simulation system without pitching simulation, compared to a real, destructive crash test. To reduce this discrepancy to a tolerable level, IST has developed a special system for pitching simulation.



Instron Structural Testing Systems GmbH
Landwehrstr. 65
64293 Darmstadt
Tel: +49 6151 / 3917-0
Fax: +49 6151/ 3917-500

Instron Structural Testing Systems Corp.
28700 Cabot Drive, Suite 100,
Novi, MI 48377, USA
Tel: +1 248 553 4630 • Toll free: +1 800 651 0924
Fax: +1 248 553 6869

For information on IST products and services call your local worldwide sales, service and technical support offices:

Japan
Tel: +81 44 853 8520
Fax: +81 44 861 0411

China
Tel: +86 21 6215 8568
Fax: +86 21 6215 0261

Korea
Tel: +82 2 552 2311
Fax: +82 2 553 9180

South East Asia
Tel: +65 6774 3188
Fax: +65 6774 1837

South America
Tel: +55 11 4195 8160
Fax: +55 11 4195 8133

www.instron.com/ist

IST INSTRON® STRUCTURAL TESTING SYSTEMS

POD IST0035 AE