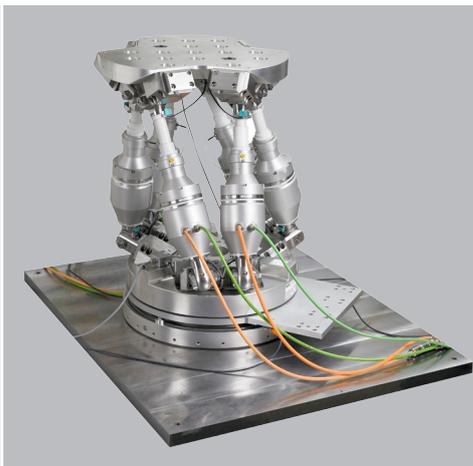


Hexapod - Applications



Technology of Switzerland



Hexapod-Applications



Robotic system with electric drive

Robotic system with electric drive

Complex production lines such as those occurring in the aerospace industry require precise positioning of the parts to be mounted on the end product. This electric hexapod allows the desired tasks to be performed exactly. The process calls for movements along a fully arched curve whose length is about 200 mm and which has an accuracy of one micrometre. Used to detect contact between the parts, the hexapod force measuring systems also apply the required pressure and equalise undesired tensions. As soon as the parts are adhered, the hexapod is responsible for delivering the assembled parts to the next phases of the production line.



Accurate Force-Control

This test stand opens completely new application areas. The controller controls the forces and moments in an arbitrary reference point in the work piece. This is either placed on top or clamped between the moving platform and inner frame. The device achieves a stunningly accuracy and the six parallel drives develop very high forces. The measurement instrumentation does not need to be complicatedly placed on the specimen, because it is firmly integrated in the drive axles.

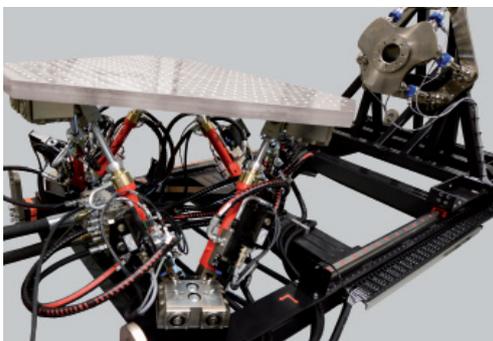
Upper image for larger specimens.



Calibration of force measuring devices

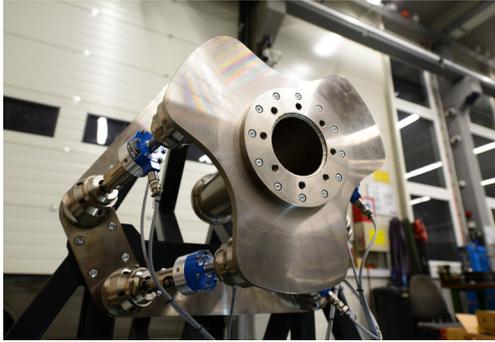
Hexamove with an integrated shaker

This unit is actually a 7dof system. The Hexapod can be adjusted horizontally on a machine base with a moveable clamping plate. This allows samples of different sizes to be clamped between a horizontal shaker and the Hexapod. While the Hexapod controls the large movements and rotations in all directions, the shaker can generate movements with frequencies up to 500 Hz.



Automotive Industry

Hexapod-Applications



Automotive Industry

6-DOF Force and Torque Measurement

A second, stationary hexapod for high-precision force measurement has already proved itself within the scope of a number of other applications. In this course, the so-called reference hexapod was usually integrated with the main hexapod. With this application, the approach was a different one: the reference hexapod for measurements has been mounted to a moveable slide at the side of the test facility.

This facilitates the most flexible realization even of rather large test setups. The measurements are highly precise and new software allows for defining characteristic curves and facilitates transfer functions. However, apart from measuring, the hexapod can also be controlled in accordance with forces/torques.



Automotive Industry

Testing of engine bearings

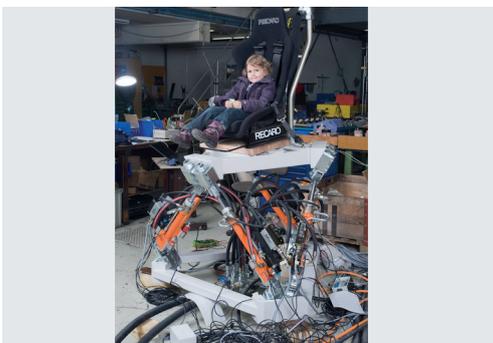
Engine bearings in vehicles are not just springs nowadays, but high-quality components with built-in intelligence, making it possible to adjust the damping properties to the current situation. This test station enables the simulation of a variety of environmental conditions. The determination of transfer functions with sweeps is a further major function, whereby the transferred forces are measured with an additional reference Hexapod.



Component test for the railway industry

Hexapod as a flexible testing machine

A new generation of software allows the mixing of displacement and position signals in Drive-Files. Each degree of freedom can be individually programmed as displacement or force signal. The test bench reaches up to 200 kN vertically and up to 100 kN horizontally. The torques ranging up to 25000 Nm. Using a step programming with function blocks the user can write complete automated process programs. This can also contain loops and let the control of data recording and external signals to.



TU Dresden, Germany

Simulation platform

A classic hexapod with much scope, a broad frequency band and considerable control possibilities. The device is suited for a broad field of applications, from simulation up to test applications. Next to the delivered software, 6 analogue in-trays (+/- 10 VDC) can be used for activation which can be processed to Cartesian (default) or axis coordinates.

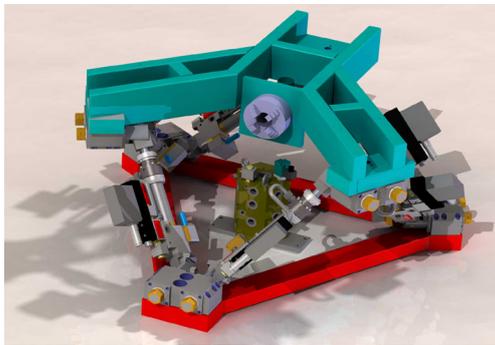
Hexapod-Applications



Mobile positioning system

Mobile yet accurate...

Pivotable around all axes, a high lifting height and options for precision control - all this combined with a high bearing load of up to 2 tons, are the excellent properties of the mobile hexapod. This unit greatly simplifies positioning activities and facilitates the mounting of heavy cargo even at high altitudes. The dumper shown takes robots that serve to automatically install solar panels onto a high steel structure. Once being aligned accurately, the robot starts autonomously and installs numerous solar panels. The high automation level is crucial for reducing the costs related to alternative energy sources in future.



Westfalia, Germany

Dynamic deforming and bending

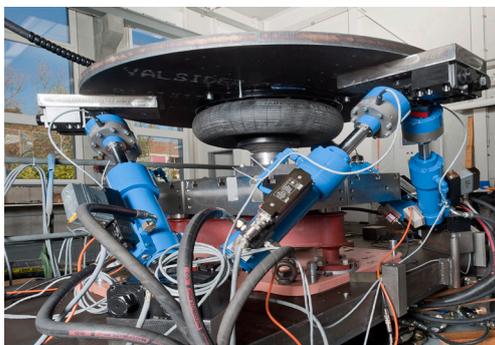
The interesting cost-benefit ratio makes the shaker hexapods the ideal engineering and inspection tools for suppliers of the car industry. The components are clamped horizontally between the propulsion part and a frame for this application. Work piece reception similar to a lathe facilitates fast installation times. The movement programmes are applied by the controls to a freely selectable work piece coordinate system.



Datenflug GmbH

Hexamove simulation system

The Hexamove simulation system with its large working area and the greatest possible tipping angle makes unusual simulation applications a possibility. With the additional high load capacity, the platform offers customers highly diverse application possibilities, either in complete simulation cabins (image) or positioned openly in a room. The simulators are characterized by a high level of dynamics. A comprehensive safety concept with interfaces for external sensor technology is an integral part of test for Oelhydraulik Hagenbuch.



Flexible testing services with Hexapod

Test of an air spring from railway engineering

A wide range of equipment involving hexapod structures and measuring devices make it possible for us to set up test benches for customer tests quickly and flexibly. The example shows an air spring with which characteristic lines were measured out and with which ongoing stability tests were performed. Forces and distances can be programmed individually.

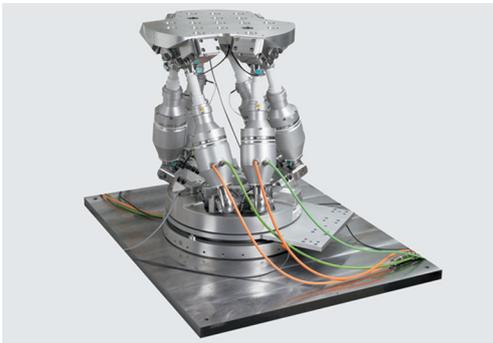
Hexapod-Applications



Heavy rescue unit

3-DOF device

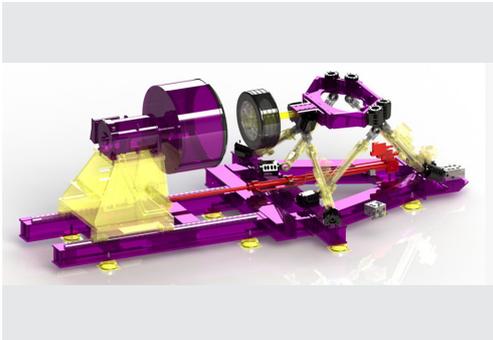
Hexapod technology is ultimately also behind this 3-DOF device. The device is designed for the recovery and lifting of airplanes (A380) and makes it possible to handle up to 165 tons. The forces are measured and adjusted upon request with rope overload. The device can achieve impressive dimensions with a stroke height up to 6 metres.



Manipulation component in neutron beam

Precision positioning and track accuracy

This variant captivates primarily by the small installation room, the high precision as well as the high load of up to 300 kg. The propulsion in this case is electric precision servomotors. One feature of this device is an additional rotation axis beneath the main platform of the hexapod. The rotation angle is theoretically unlimited; in practice due to cable routing it is in the range of +/- 180 degrees.

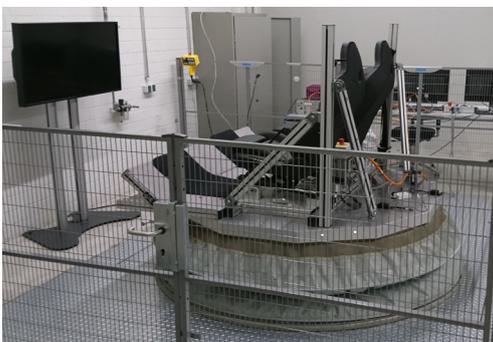


Wheel testing machine

Wheel testing machine with distance and force adjustment

This system makes it possible to define whether the forces and distances should be adjusted for each translation and rotation axis separately. The controller thereby opens up a huge new application area.

In the application shown, the rim force is tested and pushed into the turning drum. Here not only the pressure force but also the lateral force on the wheel by pressing the wheel in the drum against the shoulders. At the same time, the controller adjusts the inclination of the wheel through angle adjustment. This makes it possible to generate complete and realistic processes.

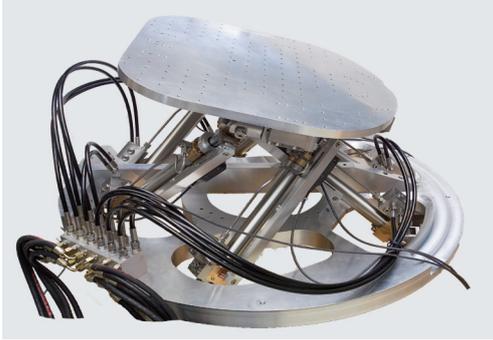


Driving comfort investigations

Driving comfort tests with hexapod simulator

The Hexamove system simulates acceleration measuring data in the laboratory. Driving comfort can therefore be evaluated with different vehicle seats in manned operations. Different measuring data are used for this, for instance data from difficult road profiles and also from typical road conditions. The measuring data are processed with motion-cueing for the simulation and simulated synchronously to the movements using HexVideoPlayer software.

Hexapod-Applications



Oak-Ridge-National-Laboratory USA

High-Precision Positioning-System for magnetic environment

This Hexapod-Positioning-System reaches new dimensions in accuracy and payload. The system can carry up to 800 kg. The repeating-accuracy reaches 0.001 degrees in the angles and less than 0.01 mm in the translation. But the main advantage of the system is the large workspace compared to the size of system. When fully retracted, the geometric height is less than 300 mm, but can move vertical about 500 mm! The complete system is built in aluminium and stainless steel, so it has no magnetic parts. There are no electronic components on the system which create magnetic fields or which are reacting to magnetic influence.



Hydro Systems

Tripod for the Aerospace Industry

The lifting equipment shown allows for lifting weights of up to 35 tons. Resting on three posts and providing a fourth central support, the lifting equipment is also capable of far lateral deflections. The vertical and horizontal forces are being measured. Depending on the respective operating mode, the lifting equipment is also capable of counter-balancing the lateral load automatically. When it comes to lifting aircrafts, this feature is of specific importance because it ensures no undue lateral loads are introduced into the aircraft's structure during the lifting process.



Airbus Industry, Spain

Precise heavy duty positioning platform

The Hexamove system is excellently suited for handling heavy loads. The depicted system carries aircraft parts up to 10 tons and positions them within a tolerance of ± 0.03 mm. Especially interesting are the measurements: The mobile system has a height of just 800 mm when retracted, but it can lift the load to a height of 3000 mm. The latest technologies for propulsion and control panel make this Hexamove a highly flexible heavy duty positioning system.

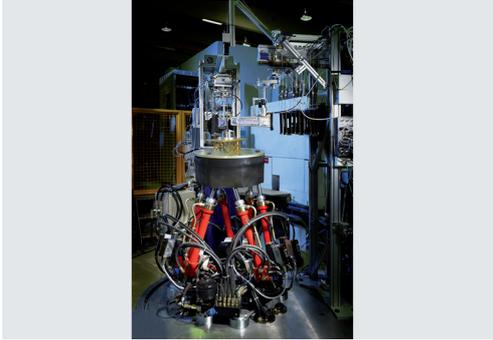


Chassis assembly A380 and A-400M

Precision Heavy Duty Platform

The Hexamove system is perfect for handling heavy loads. The system shown is capable of carrying aircraft components of up to 10 tons weight and positions them within a tolerance of ± 0.03 mm. Particularly interesting are its dimensions: when being retracted, the system is only approx. 800 mm high but can still lift the cargo up to nearly 3000 mm. State-of-the-art technology used for traction drive and control panel make Hexamove an extremely flexible heavy duty positioning system.

Hexapod-Applications

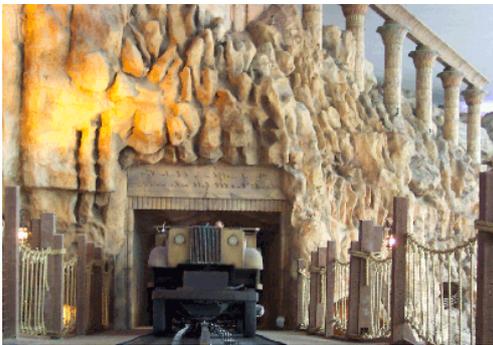


ILL France

Very accurate positioning of samples in a Neutron-Beam

The picture shows a Hexapod-System which was built for very accurate positioning of samples/workpieces in a Neutron-Beam. The accuracy of the system is better than ± 0.01 mm. The robot can handle payloads up to a weight of 700 kg. The hydraulic drives allow a very compact design with a large workspace and the 6 degrees of freedom offer a great flexibility of the system. More information can be found at www.ill.fr

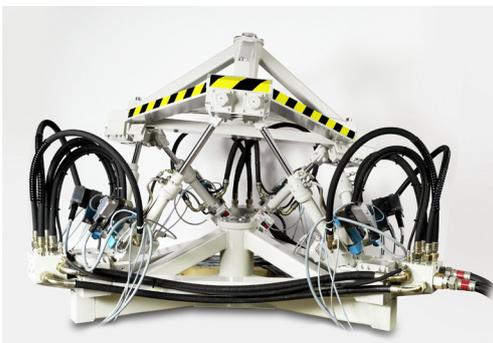
Picture: ILL, Institute Laue-Langevin, Artechnique photo, France (thanks for allowing us to show this picture)



Lotte-World Korea: Pharaoh's Fury

Motion platforms on vehicles

Strictly speaking the superimposed motion platform is a tripod and not a hexapod. Still the controls are based on the same software core as the hexapod. A feature of this installation is that the movement programme will be interpolated over the path, not over time. When the vehicle is slow, the motion is slow and with higher velocities the motion is faster. Different calibrating points make sure that the motion is always triggered at the correct position even with worn wheels. The motion controller also regulates the propulsion, so that a correct motion is ensured.



BOA BKT, Germany

Shaker applications

In Shaker applications, the test object (an individual component, modules, complete products) is clamped onto the moving platform and subjected to vibrations of very different kinds. The Hexamove-System offers a wide range of functions what makes it to a powerful engineering-tool for analysing the specimen, finding the weak points together with potential for improvement or just for live-time-tests.

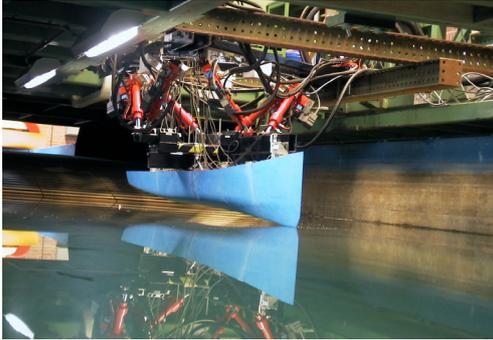


Stichting Deltares

Research for the Open Sea

Within the scope of this application, the research activities are a special task. The hexapod simulates the swaying of ships, whereas factors like heeling caused by asymmetrical payload, rolling caused by swell or vibrations can be accounted for even in combination with each other. Various goods, substances or liquids react completely differently and also cause different feedback on the vessel. This examination aims at making navigation even safer for man and the environment.

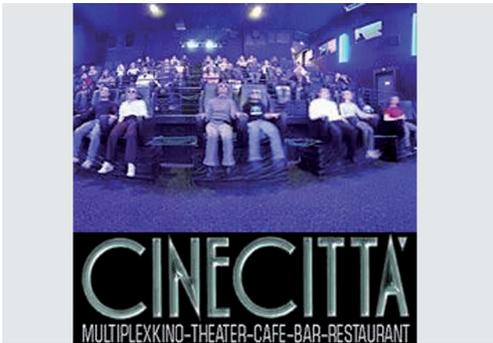
Hexapod-Applications



University of Delft, Holland

Simulation for Ship-Models in a water-tank

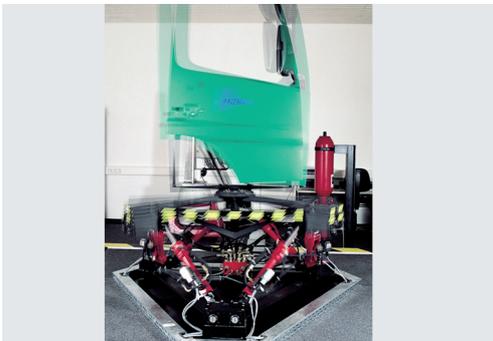
The Hexapod can also emphasize its special advantages with the testing of hull models in drag channels. Instead of producing artificially waves in the channel, the engineers turn the classical application around and move the ship's model as shown in the illustration. The measured reaction force then allow to analysis the characteristics of the ship form. With the conventional method, where artificially waves are produced in the channel, the Hexamove system permits to bring the model rapidly into precise positions. Test sequences can be accelerated in such a way (or can be completely automated!).



Cinecittà, Nürnberg

Hexapods in the cinema

In this installation 24 smaller hexapods are regulated by a motion controller. The movement programme will be interpolated in Cartesian pattern (so the user programs path and angles, not axis length) and translated individually to every platform. This facilitates moving each platform with individual intensity (the viewer has adjustment possibilities in the seat for the depicted installation).



Shaker system for truck-mirror systems

Component-Testing in the automotive-industry

The Real-Motion-Simulator (RMS) allows a very accurate replay of drive-files based on data-recording at test-roads with real vehicles. The simulation in the laboratory brings high flexibility and new options in testing. The simulator allows to adapt test-conditions and to simulate motion which is very difficult to test on real vehicles or only at high costs. The 6DOF-System brings all these functions at very interesting costs. The engineering-time is reduced and tests are already possible based on calculated data, before the final product exists. The 6DOF-System is also an interesting option when not all degrees of freedom are used, but when other special test-benches can be simulated or replaced. Hagenbuch designs, builds and tests complete systems including hydraulic powerunit, controller and user-interface with a wide range of functions.



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