MTS Hybrid Simulation Introductory Package

Quickly and affordably establish hybrid simulation capabilities for education, demonstration and basic research

MTS Systems Corporation has developed a streamlined means for obtaining the hardware, software and expert support needed to quickly establish basic civil hybrid simulation capabilities. Available for a limited time, turnkey MTS Hybrid Simulation Introductory Packages combine robust MTS physical test hardware, controls and software with industry-standard finite element modeling and integration tools to fully equip your lab for performing quasi-static hybrid simulation. Contact MTS today and learn how an MTS Hybrid Simulation Introductory Package could help your civil/seismic lab realize the benefits of hybrid simulation with minimal risk and cost and maximum speed and confidence.

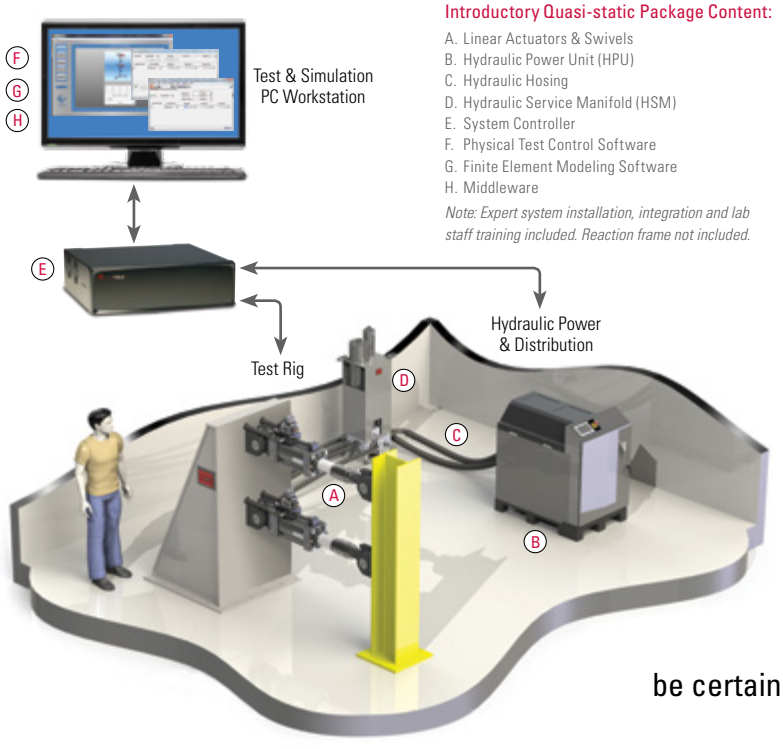
Quasi-static Hybrid Simulation

Quasi-static hybrid simulation is used to evaluate substructures or components that predominantly contribute stiffness and strength to a complete structure. Forces and motions are applied at an artificially slow rate to enable detailed study of structures under test and to accommodate a typical lab's limited physical test infrastructure. The usual scheme for a quasi-static test comprises actuators, a digital controller, a hydraulic power unit (HPU) and a test and simulation PC workstation. The simulation software runs a Finite Element Analysis (FEA) model, sending commands to the digital controller, which then activates a closed-loop control algorithm to drive the test rig to the desired location. The resulting state of the physical test rig is then communicated back up the same chain to the FEA model for the next iteration.

Unmatched MTS Expertise

MTS has commissioned quasi-static and real-time hybrid simulation systems at 85 sites worldwide, including the following prestigious civil/seismic research institutions:

- University of California, Berkeley – USA
- National Center for Research on Earthquake Engineering (NCREE) – Taiwan
- Tongji University – China
- Pusan National University – Korea
- University of Nevada, Reno – USA
- École Polytechnique de Montréal – Canada
- Southwest Jiaotong University – China
- Myongji University – Korea
- State University of New York at Buffalo – USA
- Swinburne University of Technology – Australia
- Tsinghua University – China
- University of California, San Diego – USA
- University of Trento – Italy
- Xi'an University of Architecture and Technology – China



Introductory Quasi-static Package Content:

A. Linear Actuators & Swivels
B. Hydraulic Power Unit (HPU)
C. Hydraulic Hosing
D. Hydraulic Service Manifold (HSM)
E. System Controller
F. Physical Test Control Software
G. Finite Element Modeling Software
H. Middleware

Note: Expert system installation, integration and lab staff training included. Reaction frame not included.

be certain.

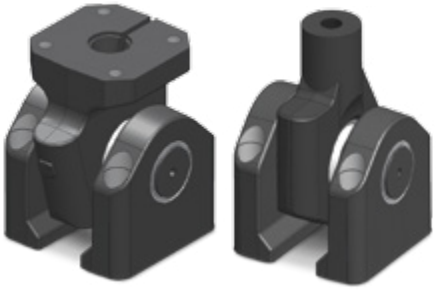
Hydromechanical Components

MODEL 201 SINGLE-ENDED HYDRAULIC ACTUATORS

MTS 201 hydraulic actuators are designed for long stroke and/or low dynamic applications and provide precision performance for low-frequency structural test and hybrid simulation applications.

MODEL 249 SWIVELS (NON-ADJUSTABLE)

Model 249 Swivels enable linear hydraulic actuators to pivot freely at the base and rod ends. An actuator equipped with 249 swivels can then be attached to a reaction mass, bedplate or structural component.



MODEL 293 HYDRAULIC SERVICE MANIFOLD (HSM)

Independent of the SilentFlo HPU, the 293 HSM ensures smooth, consistent line pressure regulation to independent test stations. A single manifold can be upgraded to serve up to four test stations.

SILENTFLO™ HYDRAULIC POWER UNIT (HPU)

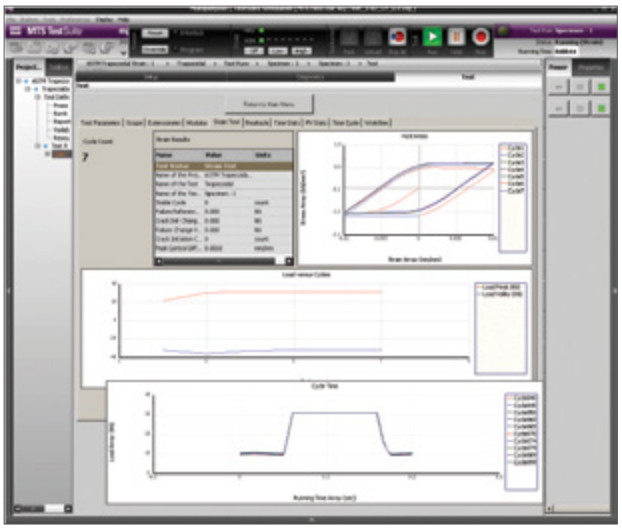
SilentFlo HPUs are known for quiet and clean operation. Capable of operating at or below 63 db(A), they can be deployed directly in the lab, eliminating the need for special pump housing facilities and reducing supply line length and space requirements. Representing the latest in HPU technology, new SilentFlo 515 units feature innovative energy efficiency and health monitoring options and system integration features to reduce total cost of ownership.

System Controller

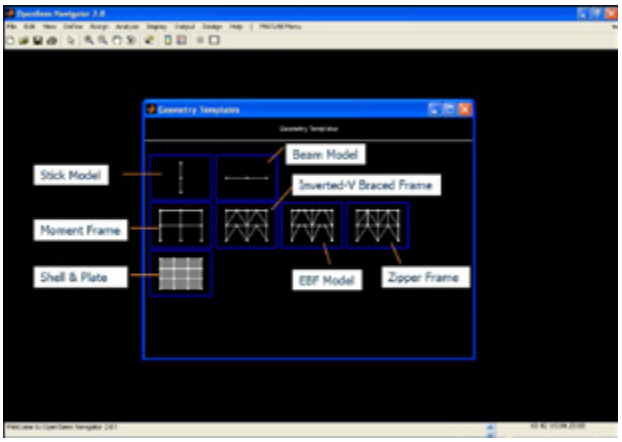
FLEXTEST® 40 DIGITAL CONTROLLER
Versatile FlexTest digital controllers allow test engineers to define and automate virtually any material, component or structural test. They deliver higher speeds and channel densities to keep pace with evolving test demands, and share common hardware boards and user interface tools, simplifying test standardization and optimization. FlexTest controllers employ a modular architecture that features uniquely field-up gradeable processors. The ability to upgrade the processors makes it easy to adapt the controllers to future test requirements and accommodate lab expansion and updates. A standalone FlexTest 40 controller can be upgraded to support up to 4-channels and 2 test stations.

System Software

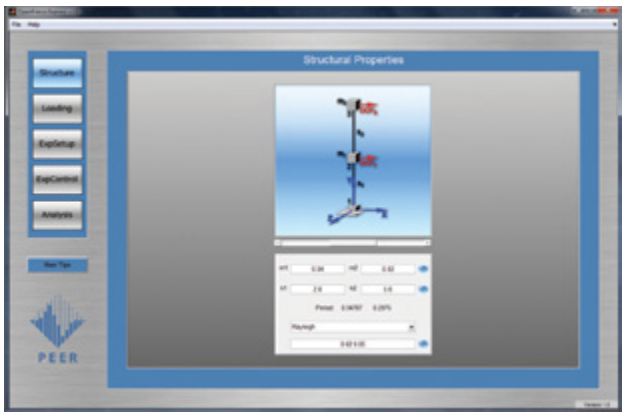
PHYSICAL TEST CONTROL:
MTS TESTSUITE™ MULTIPURPOSE ELITE (MPE) SOFTWARE
Adaptable MTS TestSuite MPE software allows you the flexibility to create and run tests that are tailored to match your exact material, component or structural test requirements.



FINITE ELEMENT MODELING: OPENSEES SOFTWARE
Developed by the University of California, Berkeley, OpenSees is highly modular and transparent open source software that allows researchers in different fields (engineering, computer science, and numerical analysis) to develop specific modules with relatively little dependence on other modules. This allows civil engineers to focus on their respective areas of expertise without having to be familiar with all elements of the simulation's framework.



MIDDLEWARE: OPENFRESCO / OPENFRESCOEXPRESS SOFTWARE
The OpenFresco middleware software framework represents the work of a wide array of research organizations, most notably the Pacific Earthquake Engineering Research (PEER) Center at the University of California, Berkeley. It is designed to connect finite element models with physical test control and data acquisition systems to facilitate hybrid simulation of structural systems. OpenFrescoExpress is a simplified version of this software, featuring an easy-to-use Graphical User Interface (GUI) that is especially useful for learning and demonstrating hybrid simulation concepts on test rigs with up to two actuators.



MTS Hybrid Simulation Introductory Package

Expert MTS Guidance

For decades, MTS has collaborated closely with leading research institutions to advance the science and technology of civil/seismic test and simulation, having commissioned state-of-the-art real-time and quasi-static hybrid simulation systems at 85 sites worldwide. The MTS team is comprised of highly experienced application and systems integration engineers who have joined MTS to be on the leading-edge of civil structures testing. They are prepared to lend expert guidance to your entry into civil hybrid simulation by supporting the installation and integration of your quasi-static system, and training your lab personnel to operate it safely and efficiently. Once your system is fully operational, this team will work with you to realize maximum uptime, maintain optimal performance and manage system upgrades to meet your evolving hybrid simulation needs.

A Variety of Packages to Match Your Precise Needs

	Package A	Package B	Package C	Package D
Model 201 Actuator(s)	**201.45A** (Quantity = 1) » 100 kip tension (445 kN) » 145 kip compression (650 kN)	**201.60A** (Quantity = 1) » 145 kip tension (650 kN) » 230 kip compression (1015 kN)	**201.45A** (Quantity = 2) » 100 kip tension (445 kN) » 145 kip compression (650 kN)	**201.60A** (Quantity = 2) » 145 kip tension (650 kN) » 230 kip compression (1015 kN)
Model 249 Swivels Sets (non-adjustable head & base)	Quantity = 1	Quantity = 1	Quantity = 2	Quantity = 2
FlexTest 40 Digital Controller	1- Channel	1-Channel	2-Channel	2-Channel
PC Workstation & System Software*	» OpenFrescoExpress » OpenSees » MTS TestSuite MPE	» OpenFrescoExpress » OpenSees » MTS TestSuite MPE	» OpenFresco Full Package » OpenFrescoExpress » OpenSees » MTS TestSuite MPE	» OpenFresco Full Package » OpenFrescoExpress » OpenSees » MTS TestSuite MPE
293.11 HSM	1- Station	1- Station	2- Station	2- Station
SilentFlo HPU	**Model 515.11** » 11 GPM/41.6 LPM @ 60 HZ » 10 GPM/37.9 LPM @ 50 Hz	**Model 515.11** » 11 GPM/41.6 LPM @ 60 HZ » 10 GPM/37.9 LPM @ 50 Hz	**Model 515.20** » 20 GPM/75.7 LPM @ 60 HZ » 16.5 GPM/62.5 LPM @ 50 HZ	**Model 515.20** » 20 GPM/75.7 LPM @ 60 HZ » 16.5 GPM/62.5 LPM @ 50 HZ
** Software Notes:*				

» *OpenFresco (Full Package), OpenFrescoExpress and OpenSees are available for download at the Pacific Earthquake Engineering Research (PEER) Center Website.*

» *Installed systems can be modified to run alternatives to OpenSees (FEA modeler), including Simulia® Abaqus, Matlab Simulink® and LS-DYNA.®*

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