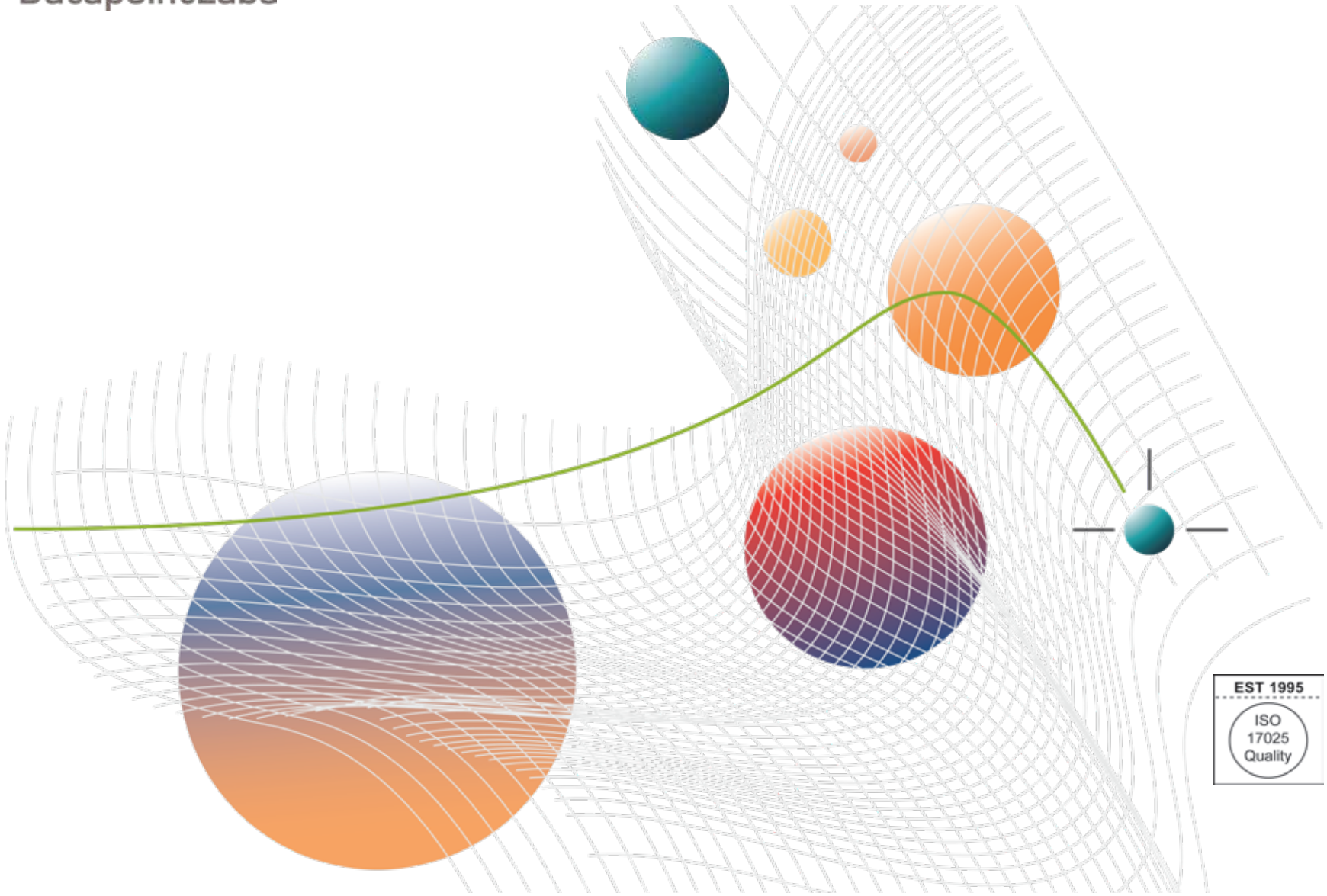
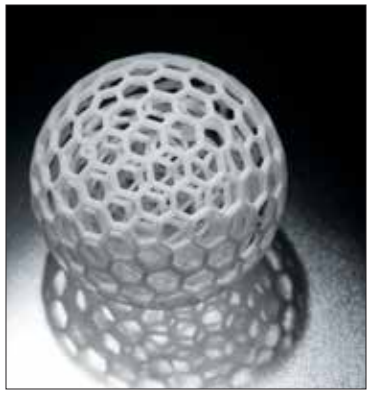
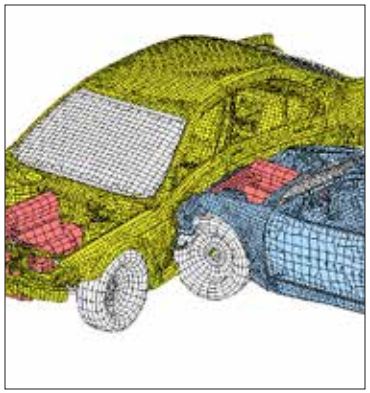
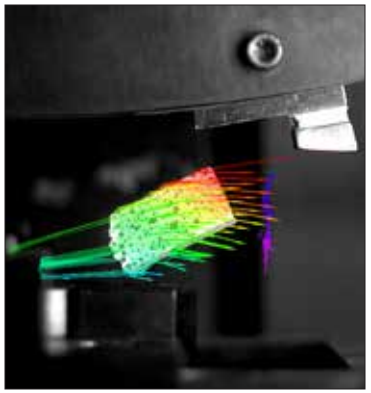
Applus DatapointLabs

Technical Center for Materials



mission

We strengthen the materials core of manufacturing enterprises around the world to facilitate their use of new materials, novel manufacturing processes, and simulation-based product development.

introduction

Materials information is used across the product life cycle for design and product development, prototyping, manufacturing, procurement, and failure analysis.

DatapointLabs Technical Center for Materials is a US-based center of excellence for the measurement of physical properties of materials needed for product development, CAE, and R&D. With our testing services and software for materials, we help companies build enduring data collections that accurately represent the materials used in their products.

material testing

TestCart

comprehensive online catalog and order system for physical, thermal, and flow properties of materials for use in product development and R&D

metals, plastics, composites, rubber, foam, rubber, films

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data for CAE

TestPaks®

material testing and material parameter conversion to create material cards for over 30 simulation (CAE) programs, including finite-element analysis, crash and drop-test simulations, injection-molding and other process simulations

pg 6

validation

CAETestBench

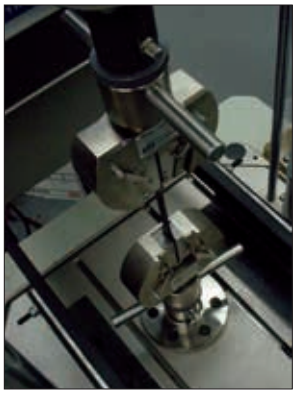
validate your simulation against a physical part, created and tested using a rigid protocol to probe the accuracy of the simulation and quantify its ability to replicate the test

validations range from simple tensile modes to more complex, multi-axial modes, impact, and failure

pg 9

expert material testing since 1995

In modern-day product development, which couples simulation with reduced late-stage prototyping, failure is expensive. Real, qualified material data removes one important variable from the design equation. Established in 1995, DatapointLabs' ISO 17025 accredited test laboratory provides 5-business-day turnaround on standard testing of virtually any materials used in the products of today and tomorrow.



"In recognition of outstanding quality performance during 2015, DuPont Engineering Polymers congratulates all employees in your organization for pride in workmanship and quality of product as indicated by full compliance with our quality standards."

Laboratory Quality Manager
E. I. du Pont de Nemours and Company
Engineering Polymers - Washington Works

EST 1995
ISO 17025 Quality

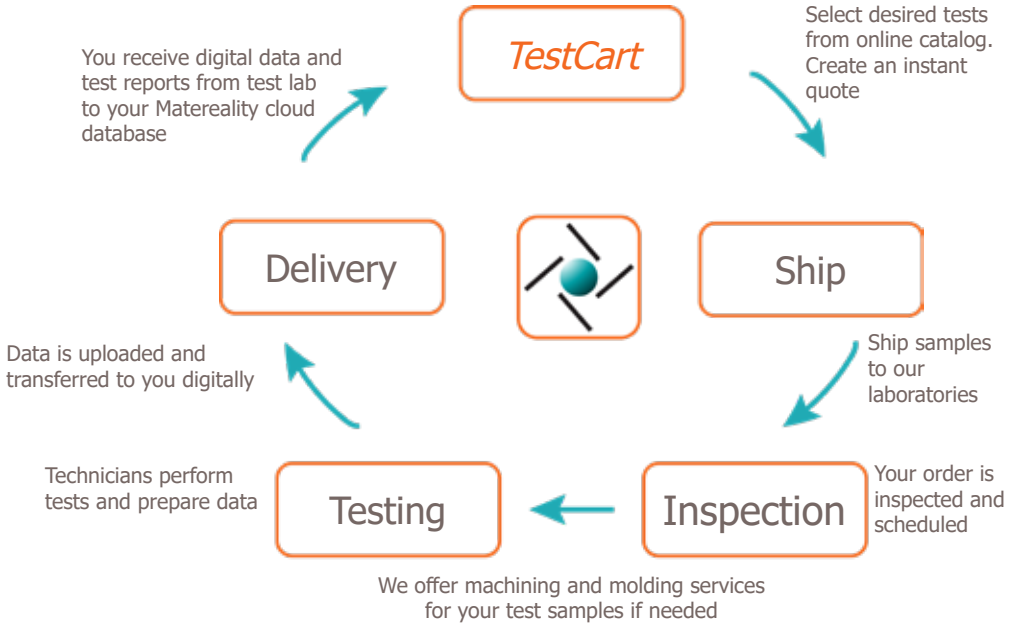
TestCart

your test laboratory: online

Use our extensive online test catalog to obtain an instant quotation for individual tests, *TestPaks,* or *CAETestBench* validations. Confirm your order and ship your materials. Our seasoned technical staff are expert in the physics of materials, measurement, and material parameter conversion for simulation.

Digital test data, test reports, and other deliverables are deposited into your Matereality libraries. You, as data owner, can use Matereality software to visualize, compare, and analyze your data, and selectively share with colleagues. Routine tasks of preparing plots or pictures for presentations, exporting to Excel, and creating material parameters using CAE Modeler become automated.

www.datapointlabs.com

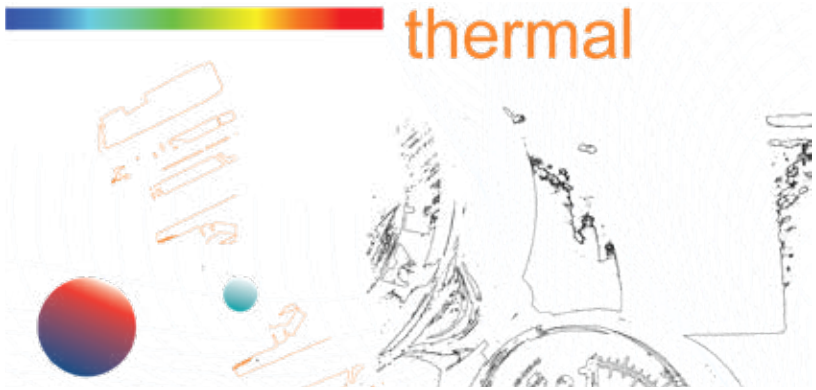


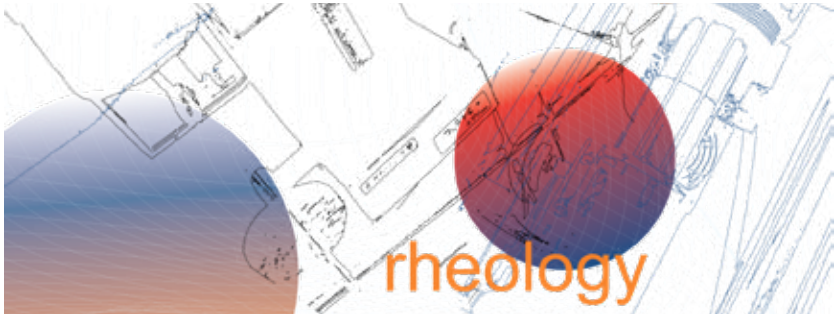
Our online test catalog and shopping cart. Your order details are transferred directly to our technicians after lab management review

- Stress-strain curves — tensile, compressive, flexural, volumetric, shear
- Modulus — tensile, compressive, shear, flexural, bulk
- Poisson's ratio — tensile or compressive
- High strain rate properties — up to 1000/s
- Hyperelastic and hyperfoam properties
- Creep and creep rupture — tensile, compressive, flexural
- Fatigue — tensile, flexural
- Impact — Izod, Charpy, Dynatup
- Volumetric properties — compressibility, bulk modulus
- Viscoelastic properties — torsion, tensile, compressive, flexural
- Stress relaxation — torsion, tensile, compressive
- Friction, wear and hardness
- Environmental exposure — heat and chemical aging
- Forming limit diagrams

Available at elevated and cryogenic temperatures, and in humidified environments

- Thermal expansion — linear and volumetric
- Thermal conductivity
- Thermal diffusivity
- Thermogravimetric analysis
- Specific heat
- Transitions — melting, solidification, crystallization kinetics
- Heat deflection temperature
- PVT – isothermal and isobaric methods, very high pressure PVT

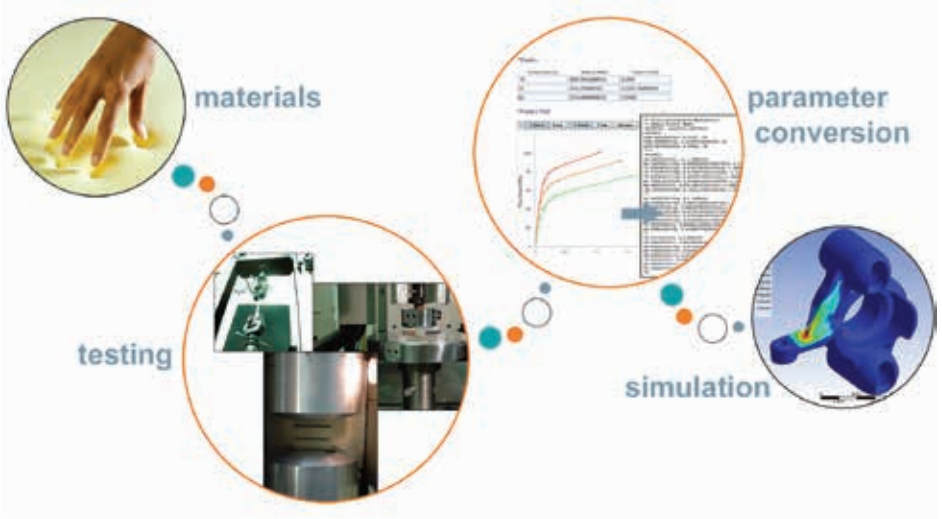




- Capillary viscosity, juncture losses, slip, die swell
- Viscoelastic properties, dynamic and steady shear
- Rheotens melt tension measurements
- Extensional viscosity — lubricated squeezing
- Melt flow rate

material parameters for simulation

Structural analysis (FEA), injection-mold analysis, computational fluid dynamics (CFD), and other CAE programs rely on precise representations of material behavior. At DatapointLabs, we have streamlined material modeling for CAE into an efficient process to consistently deliver accurate results. We have developed *TestPaks* for your programs in cooperation with our software partners. Rely on our expertise to help you select the right material models, generate the right data, and get it into your simulations, seamlessly.



TestPaks include:

- Material testing to software requirements
- Material model selection and parameter conversion
- CAE-ready material files deposited to your Matereality library

process simulations, new manufacturing

Plastics injection molding simulations require highly complex, non-linear data inputs, including viscosity, thermal properties, PVT, and mechanical properties. We have been testing materials for such applications for over 20 years!

For new processes such as 3D printing or additive manufacturing, our extensive experience with thermal, rheological, and mechanical characterizations helps our clients design and build reliable parts directly from CAD.

Blow molding and thermoforming simulations utilize extensional and viscoelastic material data inputs.

Our laboratories generate data and analysis-ready material files for all major process simulations used in the industry today.

crash & drop test simulation data

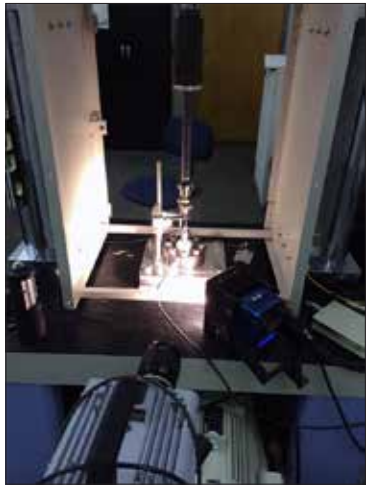
Simulation of crash and impact phenomena require rate-dependent properties. These are usually stress-strain curves measured over several decades of strain rate. We provide rate-dependent data and parameter conversion for metals, plastics, rubbers, foams, and composites, including more complex experiments to model yield surfaces, plasticity, and failure.

We also offer very high speed testing (up to 1000/s), which is used for appliance drop test, crash, and airbag deployment simulations.

Our PVT machines generate essential data for plastics molding simulations.

Using Matereality's CAE Modeler software to create a Moldflow *.UDB file.

Measuring shear properties of composites using digital image correlation (DIC).



High strain-rate measurements (to 1000/s) using 1M fps, high-speed camera with digital imaging.

Matereality supports all major molding and FEA software. Using Matereality CAE Modelers, your test data can be deployed to any of these simulations.

hyperelastic modeling of rubber

A hyperelastic material can be thought of as any type of rubbery material that exhibits large recoverable strains up to failure. Because such material is highly deformable and the Poisson's ratio is nearly 0.5, deforming the material by stretching, compressing, or twisting in one direction results in a large deformation response in other directions. This coupling means that the material behavior cannot be predicted using properties generated in only one mode of deformation. We support all commonly used finite-element simulations with multi-mode test data, along with fitting to mathematical models such as the Mooney-Rivlin or Ogden equations.

elastomeric and crushable foams

Foams are complex materials, the behavior of which can be tailored for the application purpose. The most common mode of deformation is by compression. Foams usually are not strong in tension or shear and are rarely intentionally subjected to deformation in these modes. Our support for foam modeling includes testing for factors such as rate dependency, hyperbolic extrapolation for impact simulation, and hyper-viscoelasticity.

creep, fatigue, long-term behavior

The modeling of time-based phenomena is gaining widespread use in industry as analysts try to predict the long term behavior of products. While classical creep experiments remain the mainstay for this kind of analysis, viscoelastic modeling provides predictive advantages at small strains for certain types of materials. Creep rupture experiments are useful to gauge time-dependent failure, while cyclic fatigue data are vital to ensure that products do not fail in the field.

Loading test specimens for a plate-twist shear modulus test.

Using Matereality's Viewer module to quantify the goodness of fit of a hyperelastic equation to raw data.

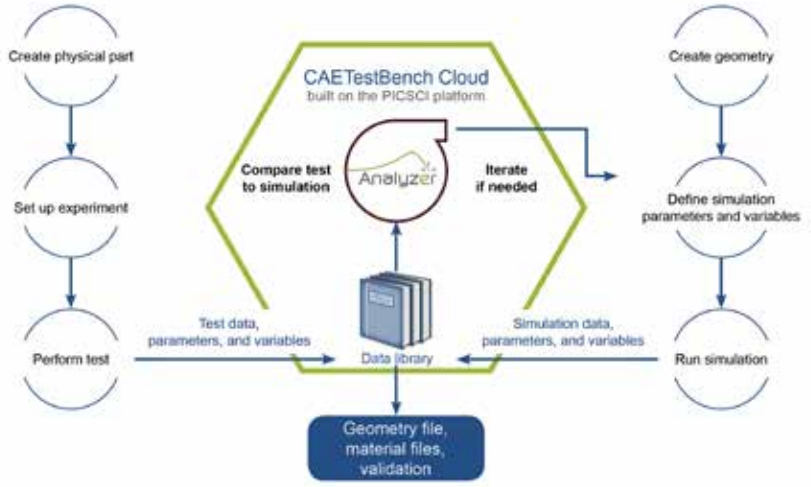
Compression test of a crushable foam.

Saline cell to measure properties for 'in-vivo' applications.

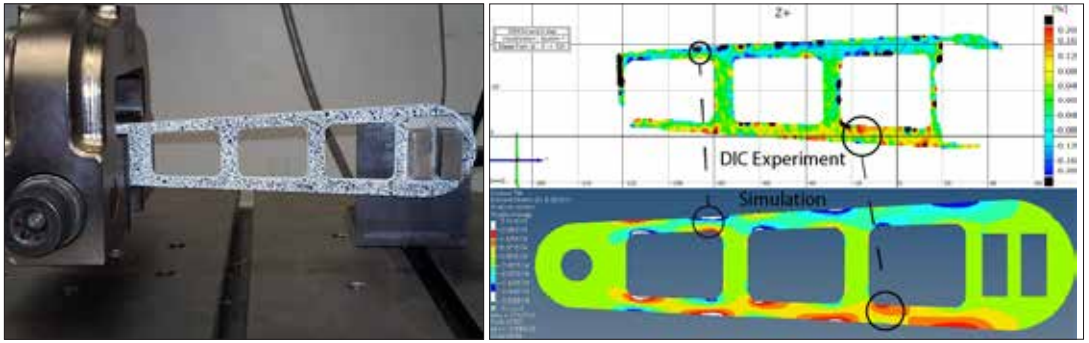
validation of simulation

Using simulation to make design decisions has created a need for greater simulation accuracy. Simulations contain assumptions and uncertainties such as solver fidelity, choice of material model, material data quality, and parameter conversion. To understand the effect of these variables, engineers can now choose to perform a validation prior to use in real product simulations.

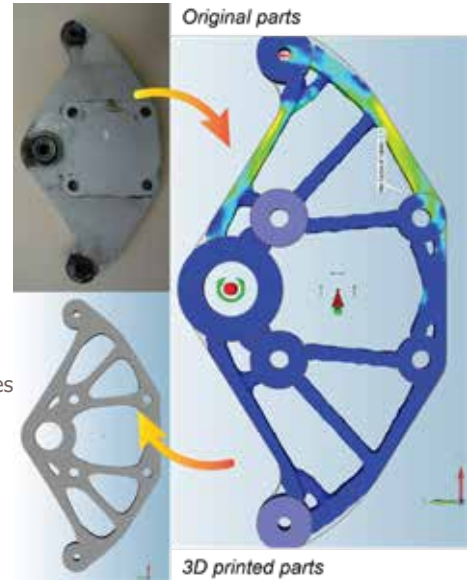
A *CAETestBench* validation quantifies the effect of the inputs to a simulation, using carefully controlled physical tests that can be simulated with precision. The tests utilize standardized parts containing geometric features that probe the accuracy of the simulation. An objective measure of accuracy can be obtained by comparing experimental strain fields obtained by digital image correlation (DIC) against the simulation.



Confirm that the simulation can predict complex cases



Validation of simulation for a 3D-printed aluminum, using a standardized bike crank (from Cornell's Swanson Laboratory for Advanced Engineering Simulation) and DIC.



Validated simulation produces a reliable tool for topology optimization of complex 3D printed structures.

Applus+ Software

digitalization software

Digital transformation is being applied to all aspects of enterprises today. A robust digital infrastructure provides workspaces for daily tasks, while consuming and organizing data in the background. Enormous benefits in operational efficiency, productivity and accuracy can be achieved by going fully digital, with a unified infrastructure to handle all data without gaps. Data is repurposed for other users as needed, remaining traceable and interlinked, for better integration and collaboration.

Technical information is complex and diverse, and hence one of the last frontiers of digitalization. Applus+ Matereality's patented software has been created for these challenging tasks, with proven field-tested reliability. Our group now has software and services that facilitate all interactions with materials information across the simulation and product life cycle.

materials & processes

matereality

build and manage curated material data collections for use across your ecosystem and product life cycle, including advanced tasks: simulation material modeling, specifications management, and master material file management

test laboratories

eLim

lab information management infrastructure for the operation of test laboratories, fully integrated data gathering, analytics, and collaboration tools

R&D laboratories

picsci

electronic lab notebooks for scientific experimentation beyond materials, allowing scientists and engineers to develop and implement testing programs, collect, analyze, and report

Tools for data visualization, comparison, analytics, report writing, presentations, and collaborations

simulation partners

DatapointLabs' materials experts have been serving material inputs for leading CAE solvers for over two decades. Our experts are familiar with your materials in simulation needs, and in with cooperation with our software partners, we provide complete solutions to your material modeling questions.

Knowmats

curates the knowledge of the world related to materials in simulation using contributor posts, links, and preprints from simulation professionals in academia, software companies, consultants and material modeling experts

about Applus+ DatapointLabs

DatapointLabs was founded in 1995, by Cornell University alumni, with a mission to provide scientifically accurate material data for use in engineering design and simulation. To date, more than 30,000 materials have flowed through the laboratory, providing data for over 1,200 companies in 11 manufacturing verticals including aerospace, automotive, biomedical, consumer products, electronics, and material suppliers.

Matereality, started in 2002 to meet the challenge of managing vast amounts of highly diverse data, now provides robust, field-tested, patent-protected, cloud and enterprise software to companies seeking to gain control of their materials information, test labs, and R&D facilities.

In 2018, DatapointLabs and Matereality joined the Applus+ Group, a worldwide leader in the testing, inspection and certification sector. DatapointLabs forms part of the Applus+ Laboratories division, which provides a wide range of testing and engineering services to industrial sectors including aerospace, automotive, electronics, information technologies, and oil and gas.

In the field of materials testing, Applus+ has a network of laboratories in Europe, USA, and China, specialized in characterization tests and quality control for metallic and non-metallic materials.

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Worldwide customer base