

Materials Gateway 3.0 for Abaqus/CAE - Enterprise-wide Materials Knowledge for Abaqus Users

2015 SCC



GRANTA
MATERIAL INTELLIGENCE

www.grantadesign.com

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Granta Design—innovating since 1994



UNIVERSITY OF
CAMBRIDGE



ASM
INTERNATIONAL

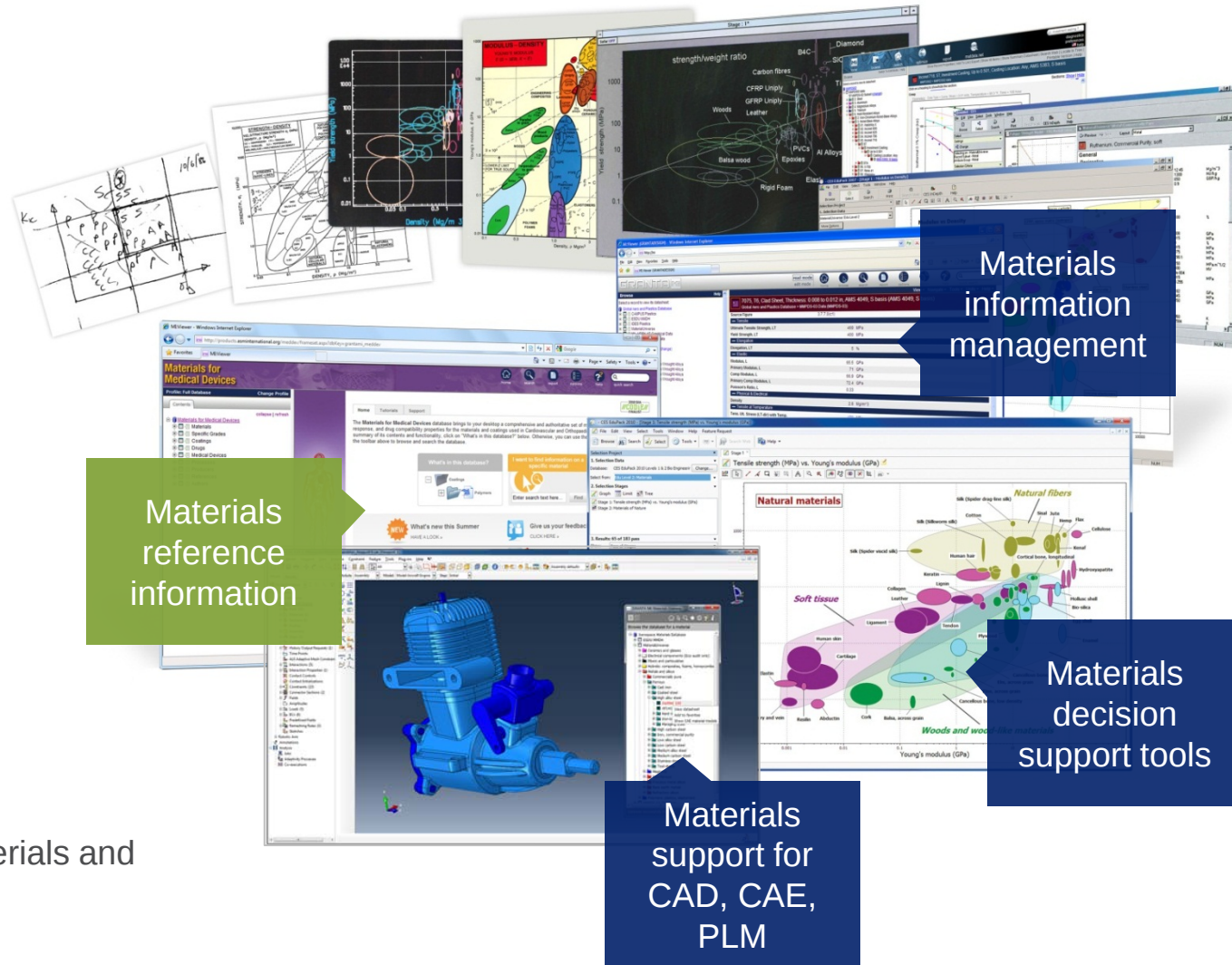
Materials information
technology is...

Software

+

Information

...related to engineering materials and
their properties



Guided by industry experts

- Secure, best-practice management of mission-critical data
- Designed with leading organizations in this sector to meet key requirements



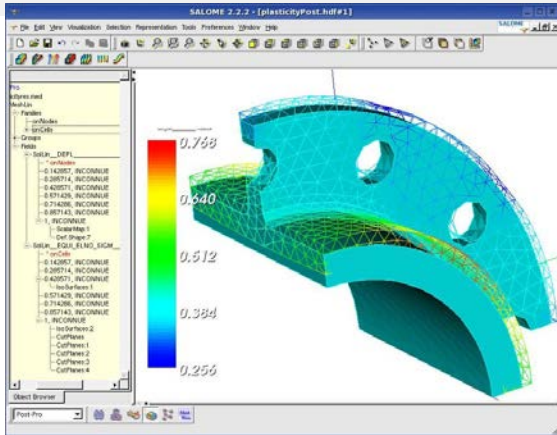
*Focused on best practice
materials data
management for
aerospace, defense,
and energy*



*Focused on best practice
materials data
management for
Automotive OEM and
suppliers*

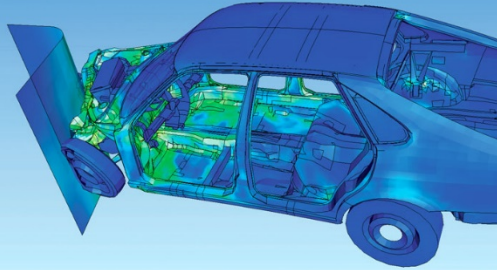
- ✓ Capture, consolidate & compare to increase confidence
- ✓ Fully searchable electronic data to support Design & Engineering
- ✓ Traceability, Versioning and quality control
- ✓ Dynamic Access control and Workflow support

Increasing data needs for CAE

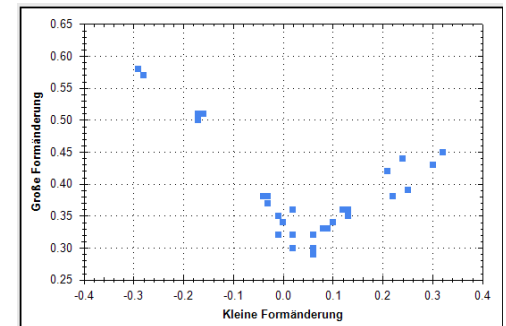
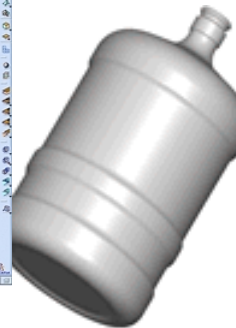
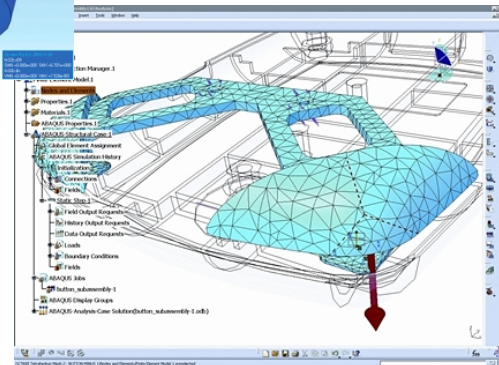
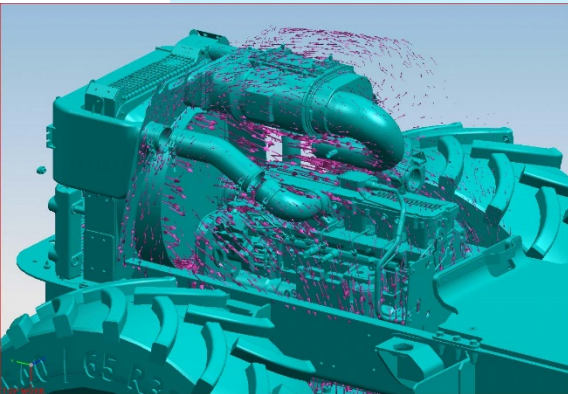


Data needed up-front for effective “what-if” trade studies in design

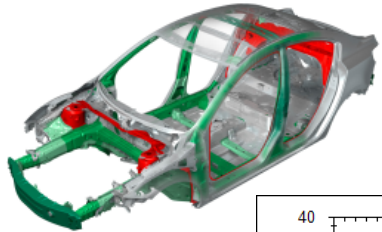
Simulation and optimisation increasingly featuring in design



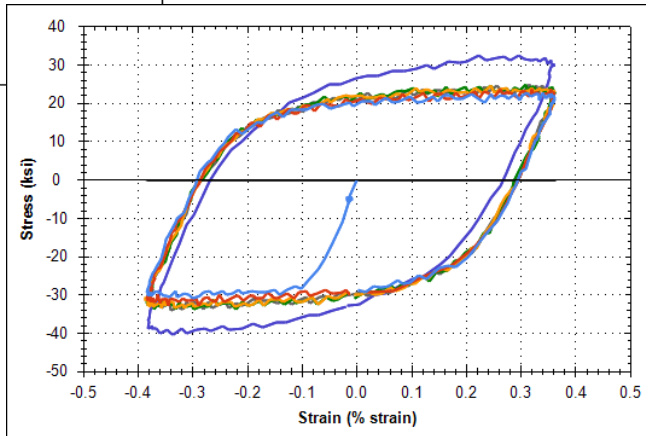
Simulations ever more sophisticated



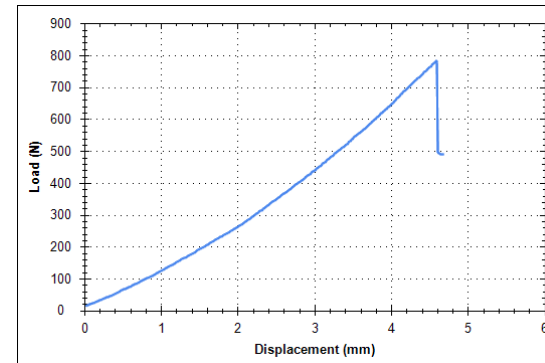
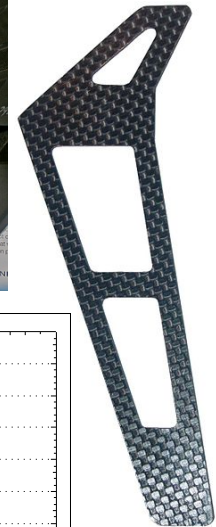
For ever more materials



Higher strength steels...



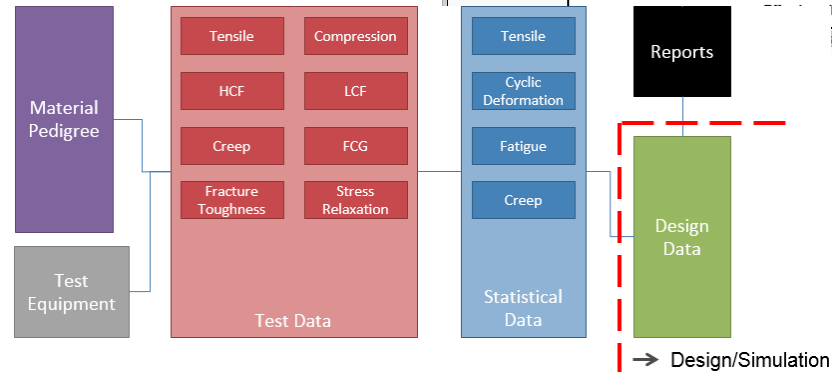
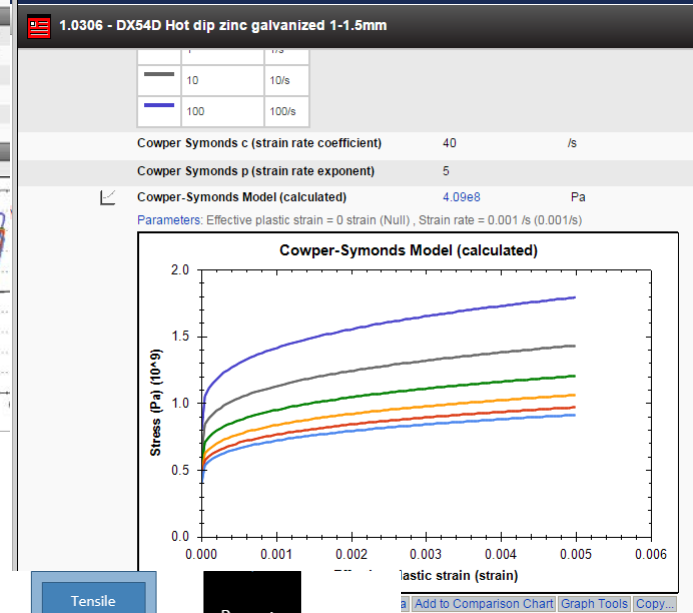
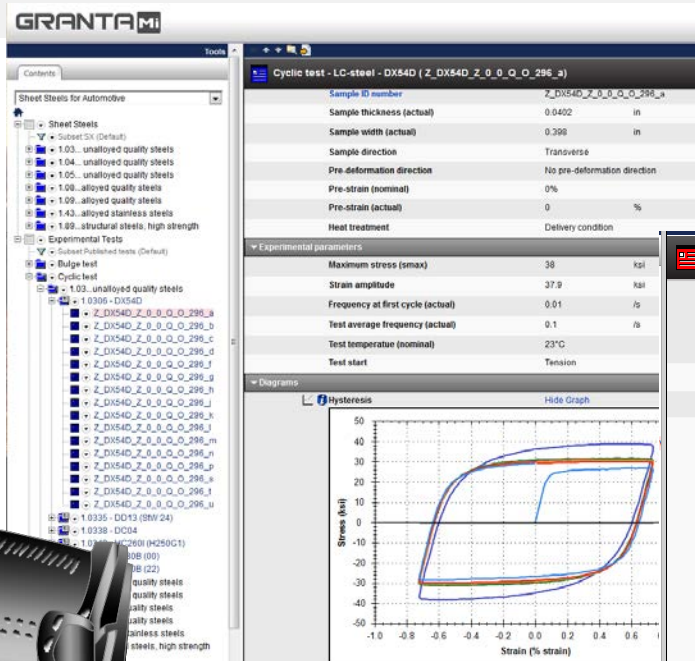
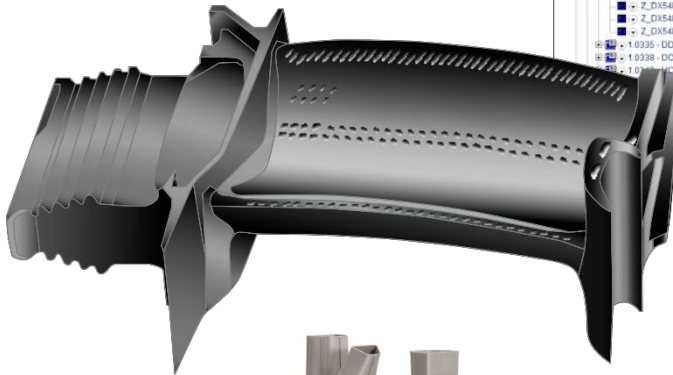
Composites...



Natural fibers...

... more data, variables, issues

And full traceability for highest quality



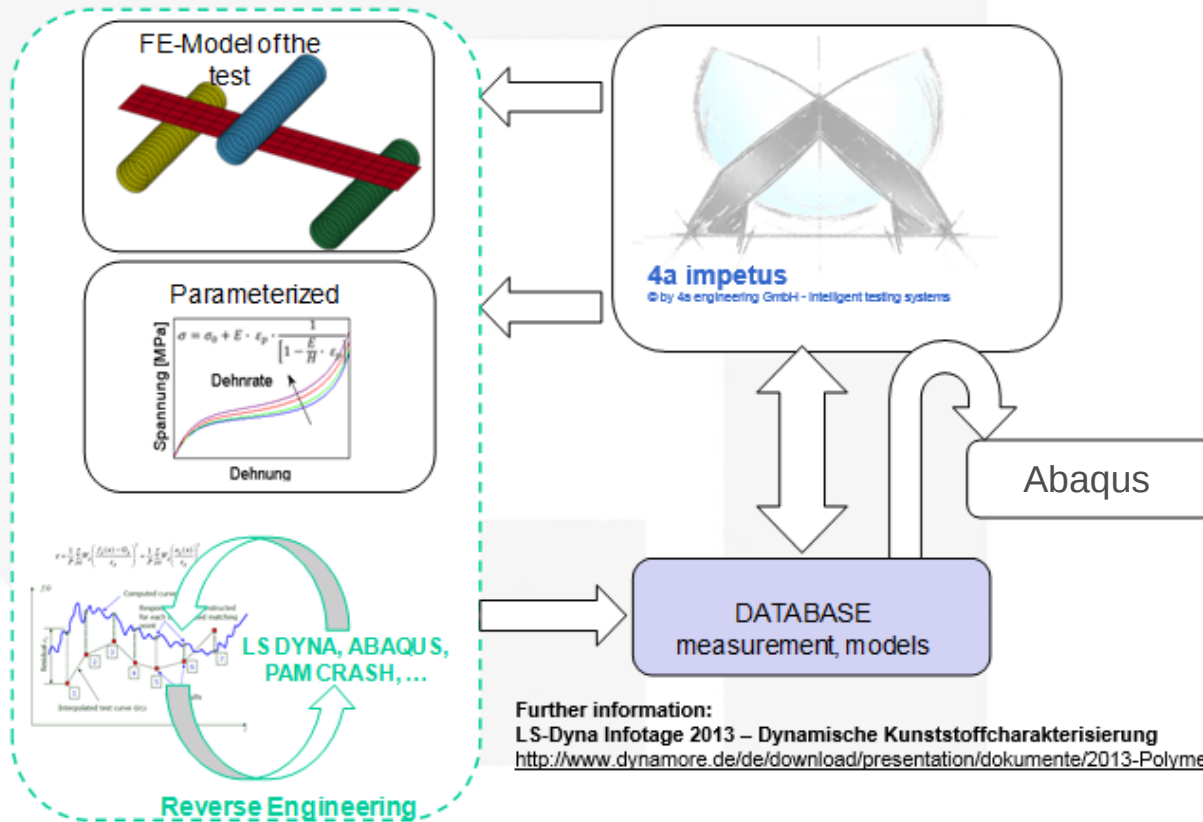
Based on test integration for validated material cards

4a impetus

How does it work

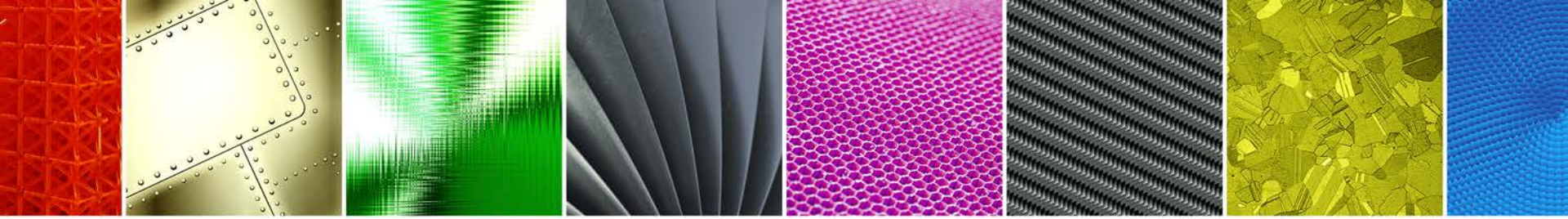


Material characterization / reverse engineering



Seite: 8 / 41
Autor: Peter Reithofer, Artur Fertschej
Datum: 150428
Titel: rep 15042801 pr after oga SOC2015.ppt

I N P H Y S I C S W E T R U S T



Process perspectives



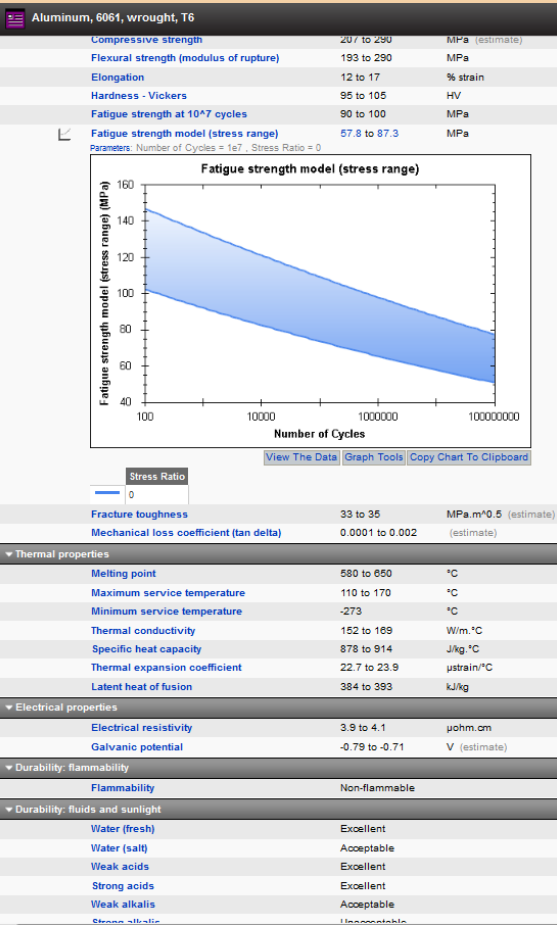
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Assigning materials properties from a gold source

“Gold Source” managed database and software tools



Name	Aluminum 6061
Density	2.71 kg/m^3
Youngs Modulus	68.9 Gpa
Poissons Ratio	0.33
Yield Strength	241 Mpa
Ultimate Tensile Strength	290 MPa
Thermal Conductivity	167 W/m °C
Thermal Expansion	23.6 µstrain/°C

Relevant, correctly-versioned properties made available when requested

Get accurate, up-to-date properties

Select and assign

Name	Aluminum 6061
Density	2.71 kg/m^3

CAE

CAD

PDM

Product Lifecycle

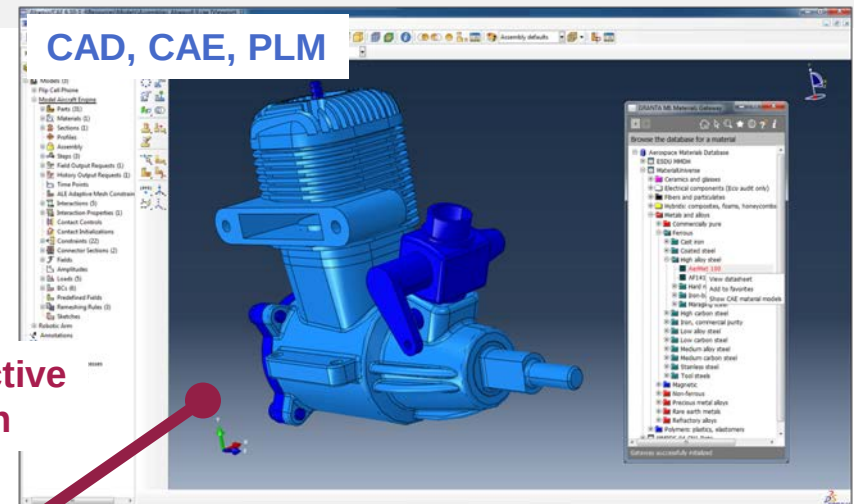
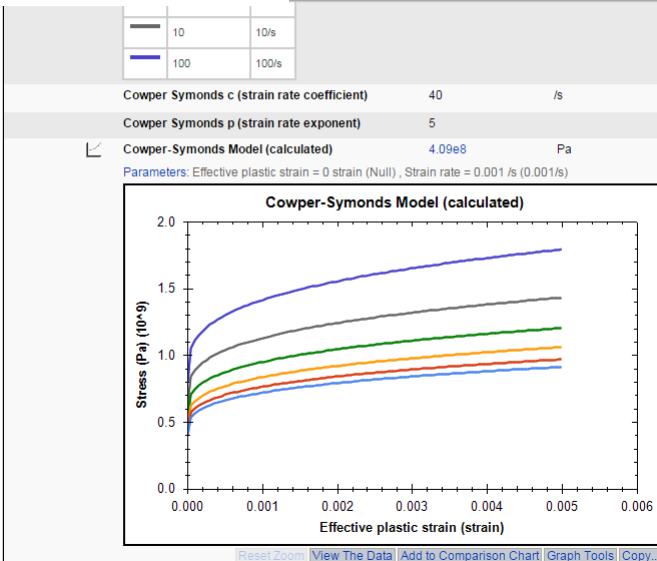


In the formats required by the solver

Ensuring engineers, CAE analysts and designers have:

- the data they need
- when they need it
- in the format they need

Materials Datasheet



Via interactive application

Via text file export

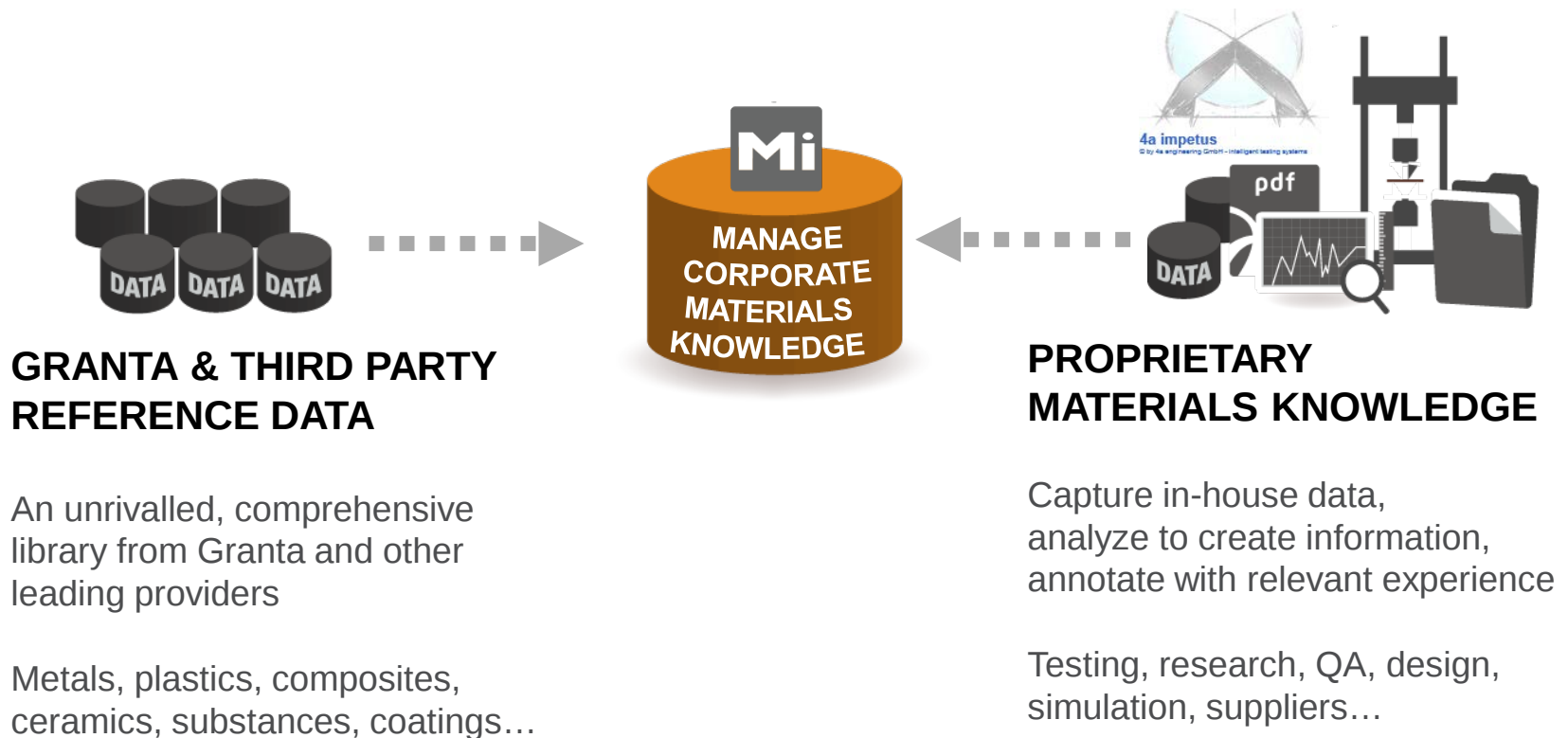
Exported Data

The export file for Abaqus 6 (model 'Temperature-dependent, isotropic') is shown below

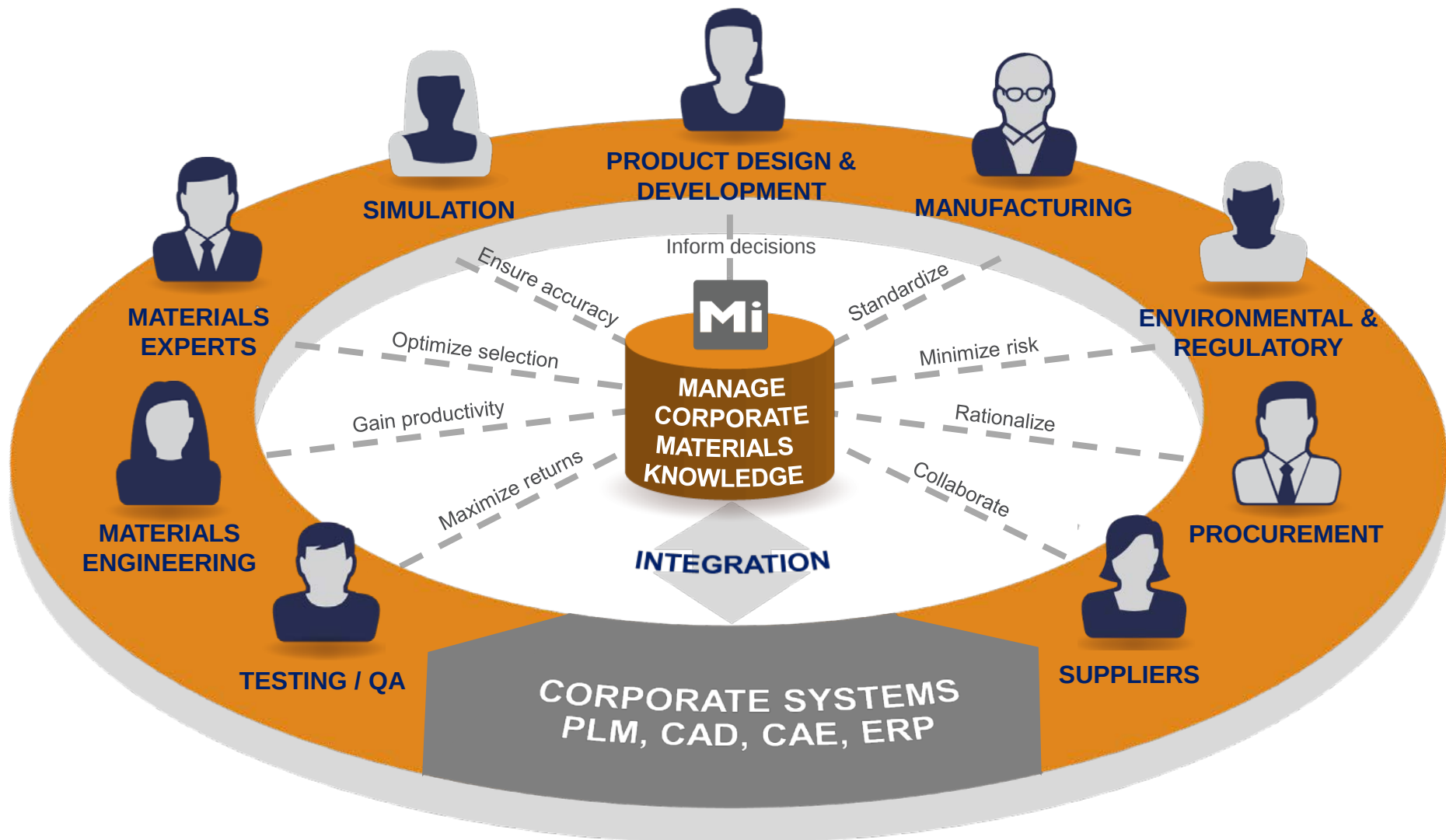
```
** MI PROPERTIES : Elongation, Value: 0.0539, Units: <No Unit>
** MI PROPERTIES : Thermal conductivity, Value: 157, Units: W/m.K
** MI PROPERTIES : Electrical resistivity, Value: 0.0000000449, Units: Ohm.m
** MI PROPERTIES : Specific heat capacity, Value: <No Value>, Units: J/kg.K
** MI PROPERTIES : Dielectric constant (relative permittivity), Value: <No Value>
**
*MATERIAL, NAME = Wrought_aluminum_alloy_2024_T6
**
*ELASTIC, TYPE = ISOTROPIC
8.278e+10, 0.337, 77.5
7.786e+10, 0.337, 190
7.451e+10, 0.337, 270
7.261e+10, 0.337, 328
7.178e+10, 0.337, 370
6.896e+10, 0.337, 420
6.482e+10, 0.337, 463
5.912e+10, 0.337, 502
5.521e+10, 0.337, 527
5.200e+10, 0.337, 551
**
*FAIL STRESS
4.490e+8, 3.770e+8, , , , , 298
**
*FAIL STRAIN
0.0539, , , , , 298
```

e.g. CAE, fatigue life analysis software, crash/forming codes

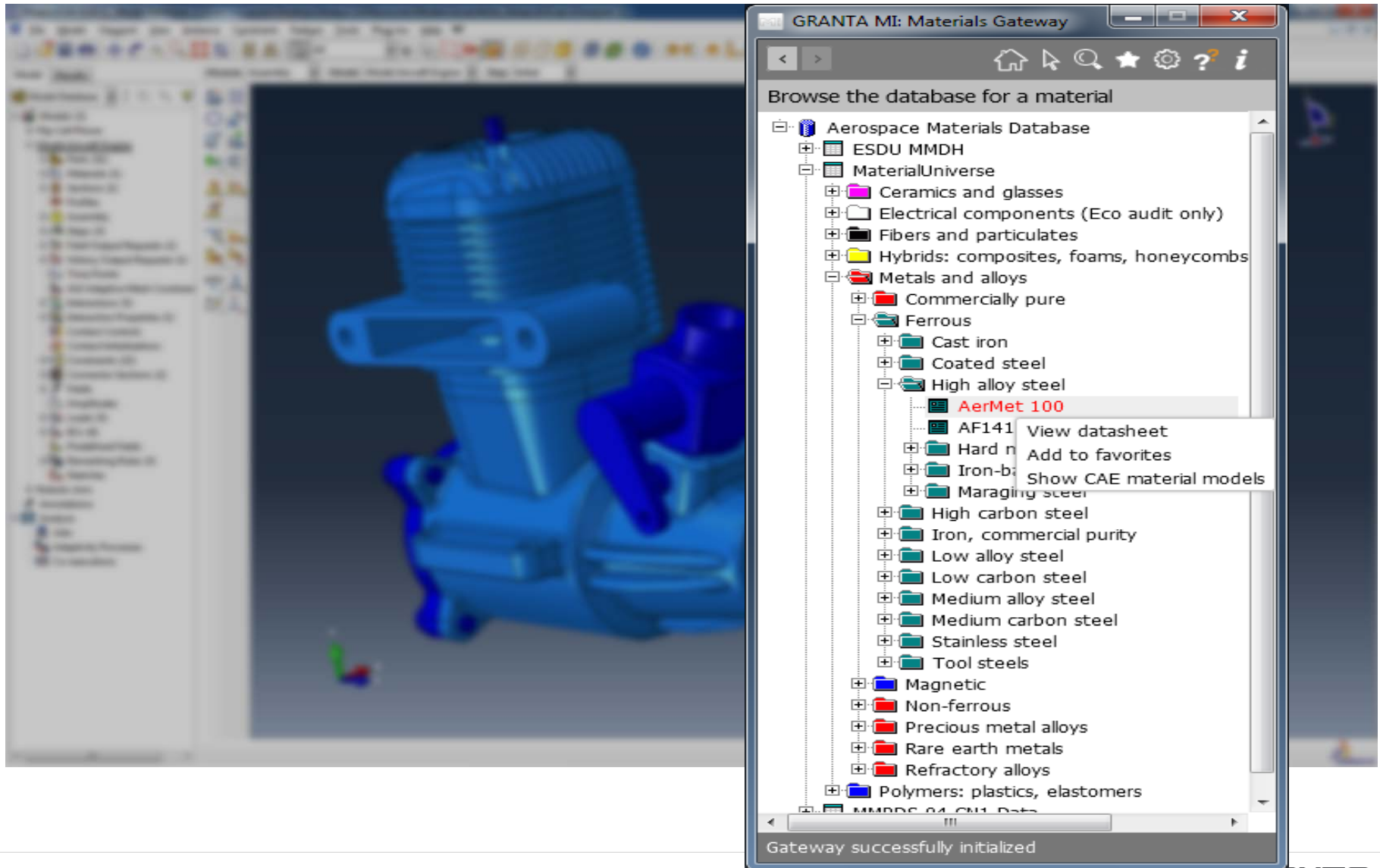
The solution: Material Intelligence with GRANTA MI



Integrated in the enterprise environment



Specifically beneficial for simulation teams



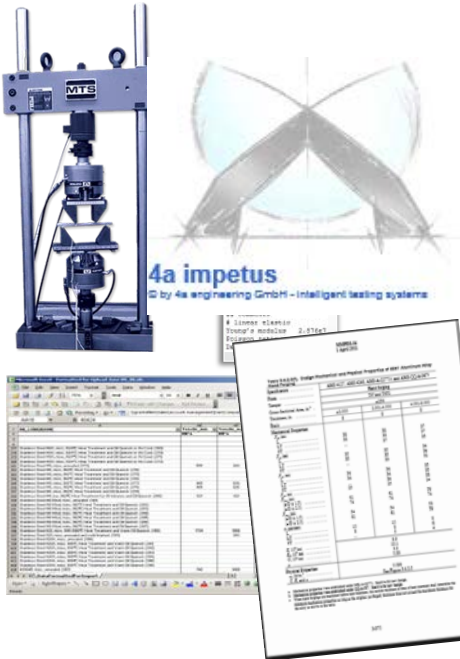
Links CAE with materials information

- GRANTA MI Abaqus/CAE Gateway 3.0
 - Software client **for traceable data transfer** from approved materials data repositories directly into Abaqus/CAE software
 - **Version-controlled** to ensure valid simulations
- **Reduces** time searching for materials data
- **Improves** the fidelity of simulation
- **Focuses** engineers on driving new and innovative products

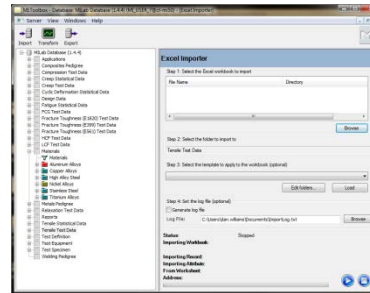
Uses your corporate 'Gold Standard Data'

1. Inconsistent data from multiple sources

(test labs, suppliers, in-house labs, legacy databases)

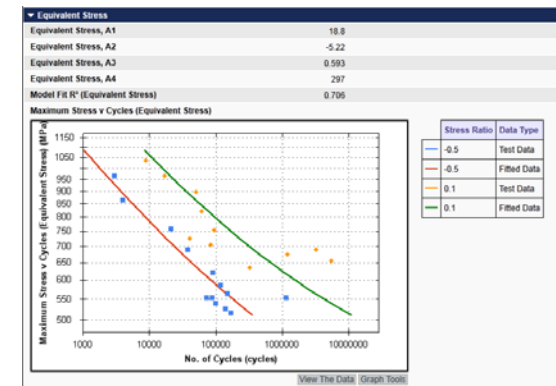


2. Flexible import and statistics



- Secure, automated import
- Remove inconsistencies,
- Notify stakeholders
- Version Control
- Workflow to approve, release and publish

3. Secure, traceable data made available to end users



Or uses Granta reference data

MMPDS



- Aerospace & Energy Data Series

MMPDS (Mil-Hdbk-5) aero alloys and Mil-Hdbk-17 composites,
ASME Boiler & Pressure Vessel Code, ...

- Plastics Data Series

Including the CAMPUS and IDES plastics datasets



- Medical Data Series



Including Plastics, Cardiovascular and Orthopaedic modules

- Universe Data Series

Engineering, cost, and environmental data for over 3,000 materials

CAE material model derivation

Access parameters needed by *specific* “materials cards” for *specific* CAE programs

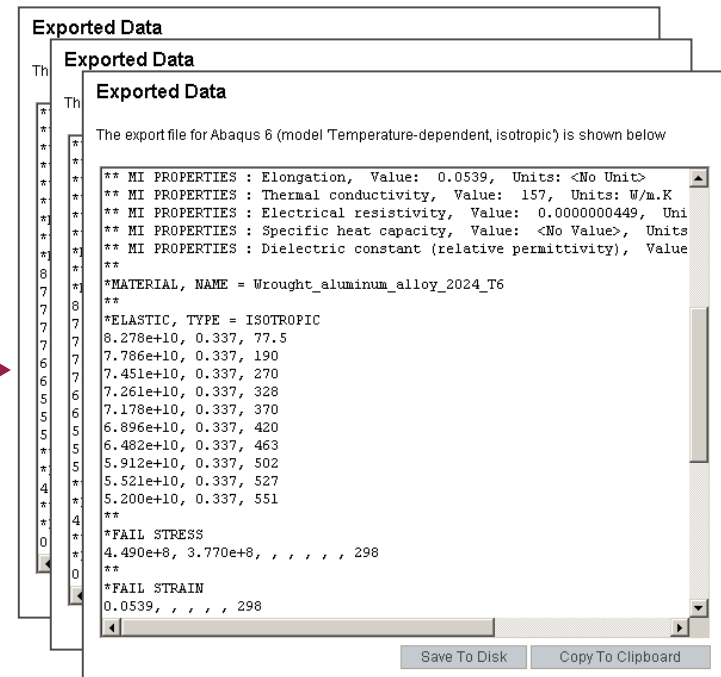
On-demand derivation can include data smoothing, interpolation, coefficient derivation, ...

Templates easily compiled for:

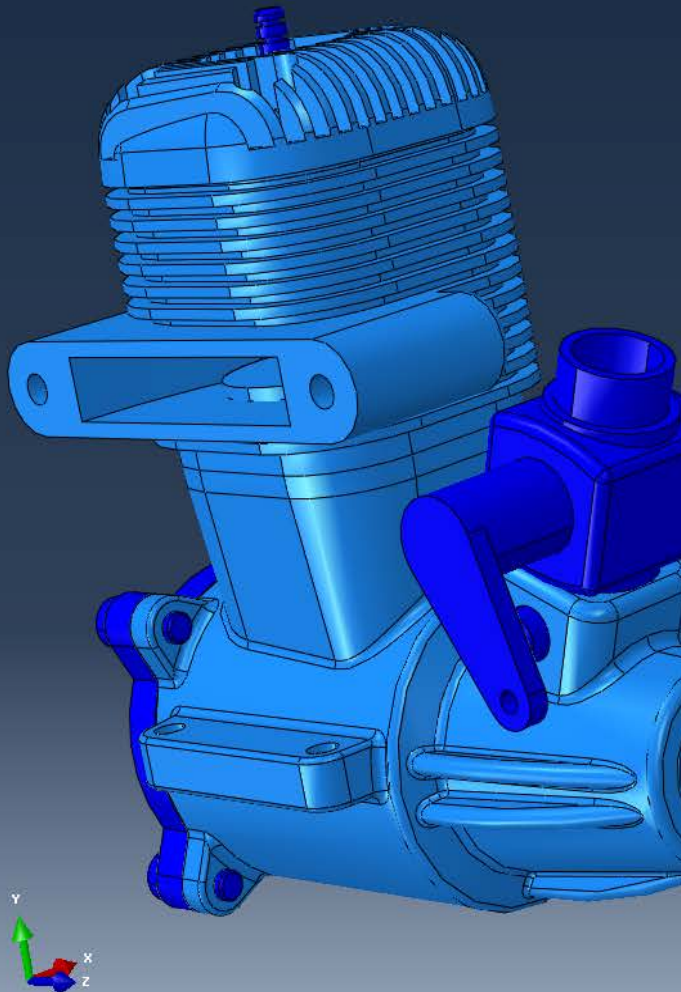
- Commercial CAE codes
- In-house tools



Transform(s)



'Pull' materials data into CAE



Edit Material

Name: LISOT_NICKEL-FE-CR_ALLOY_HAYNE

Description: GRANTA Material Name: Nickel-Fe-Cr alloy, HAYNES HR-120, annealed
Model Type: Linear, temperature-dependent, isotropic Edit...

Material Behaviors

Density

Elastic

General Mechanical Thermal Other Delete

Elastic

Type: Isotropic Suboptions

☒ Use temperature-dependent data

Number of field variables: 0

Moduli time scale (for viscoelasticity): Long-term

☐ No compression

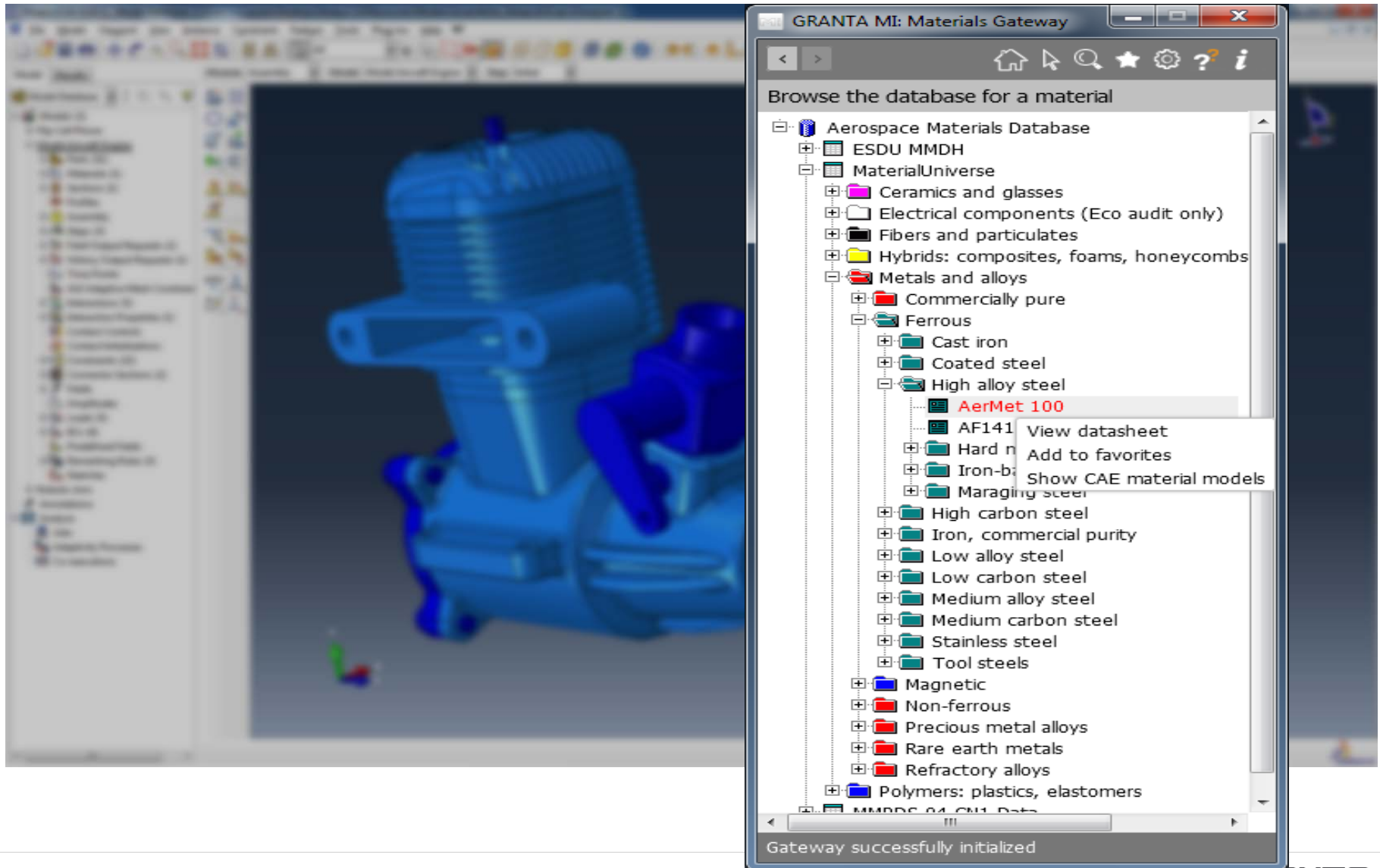
☐ No tension

Data

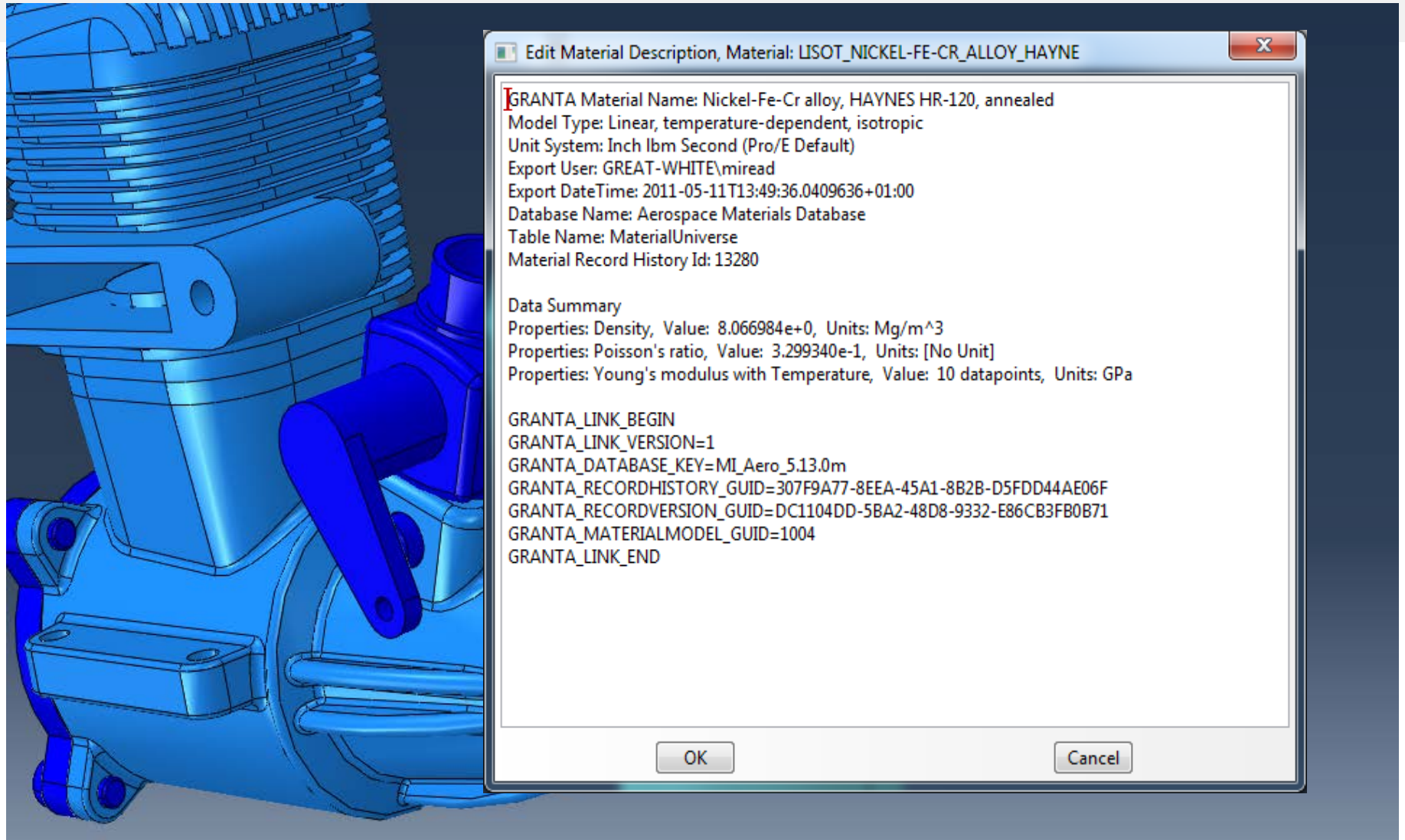
	Young's Modulus	Poisson's Ratio	Temp
1	197.0334	0.329934	21.11099
2	194.2778	0.329934	93.33401
3	187.3884	0.329934	204.445
4	181.1879	0.329934	315.556
5	171.5429	0.329934	426.667
6	162.5867	0.329934	537.778
7	155.0085	0.329934	648.89
8	146.7416	0.329934	760
9	137.7854	0.329934	871.11
10	129.5185	0.329934	982.22

OK Cancel

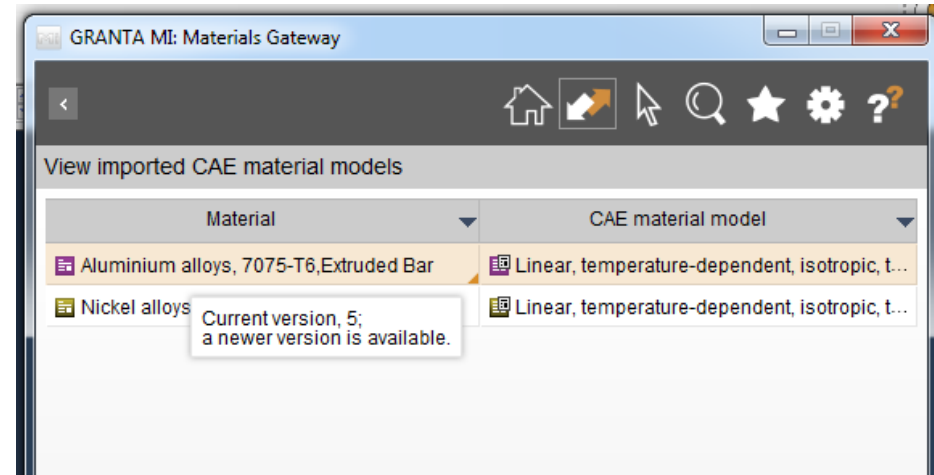
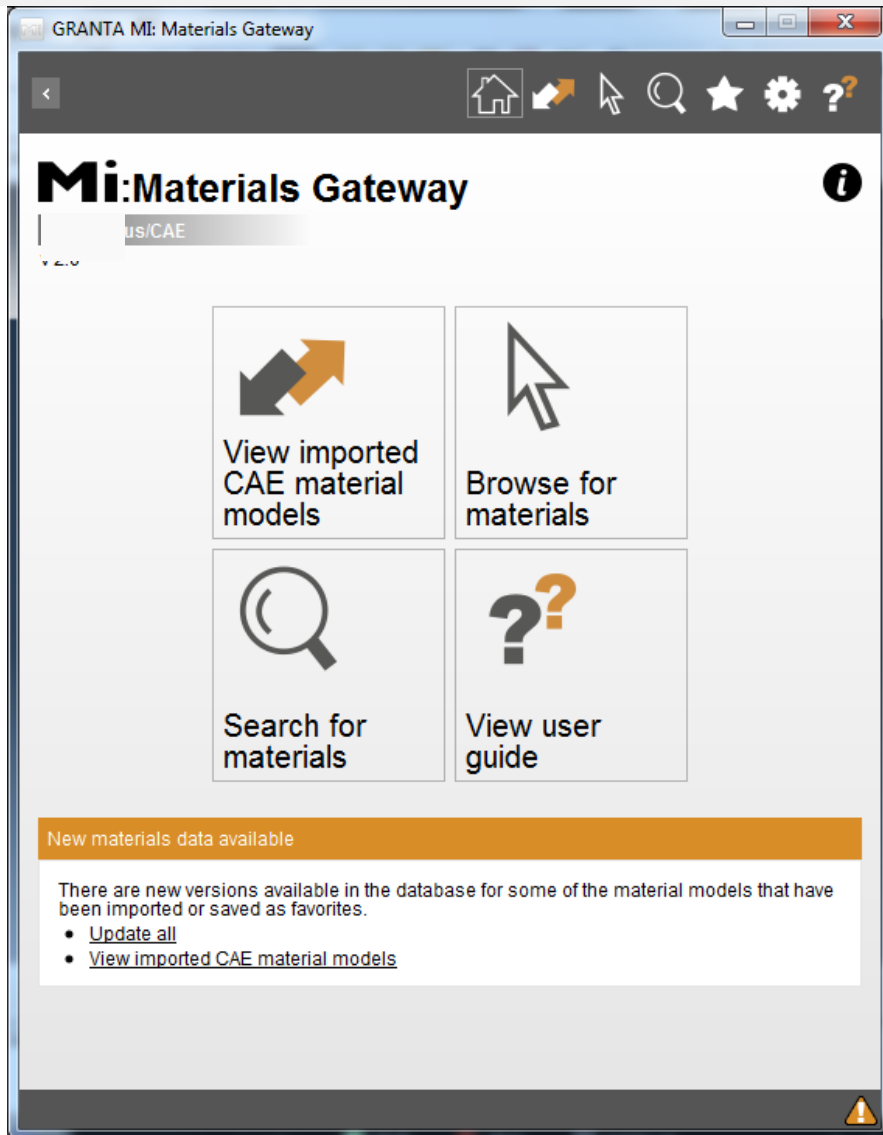
Browse and search for materials data



Ensuring full traceability



And version control and notification



GRANTA MI Materials Gateway 3.0 to Abaqus/CAE

- Enterprise-wide access to approved materials data
 - From the materials engineers who generate it
 - To the design and simulation engineers who need it
 - From within Abaqus/CAE software
- By Granta Design
- Materials information technology experts since 1994
- For
 - Seamless collaboration between Materials, Design, & Simulation
 - Enhanced simulation productivity, quality with and traceability

<http://www.grantadesign.com/products/mi/abaqus/>