Academia

gc@dyalog.com

jgl@dyalog.com

DYALOG ^ Academia

OUTLINE

1. Academia
2. Dyalog and academia
3. APL in research and education

gc@dyalog.com

jgl@dyalog.com

Academia

Academia

Education

Research

Academia

Education

Teach what we already know

Research

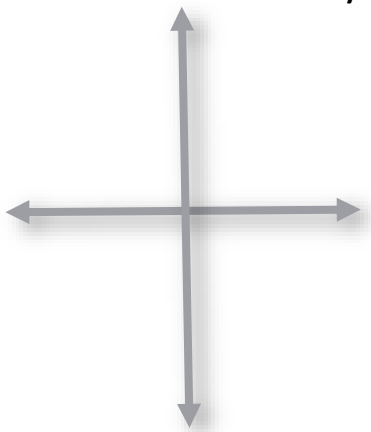
Learn new things nobody knew

Academia

STEM

Education

Teach what we already know



Science

Engineering

Research

Learn new things nobody knew

Science and Engineering

Engineers use science to solve their problems if the science is available. But available or not, the problem must be solved, and whatever form the solution takes under these conditions is called engineering.

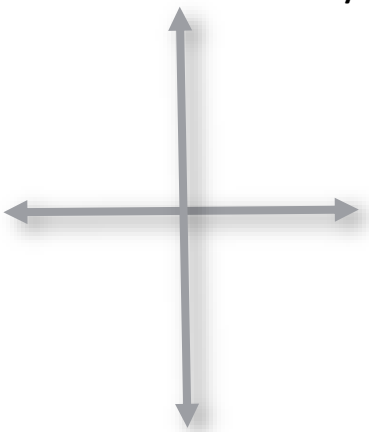
– Joseph E Shigley. *Shigley's mechanical engineering design*

Academia

STEM

Education

Teach what we already know



Science

Understand how things works

Engineering

Make things work as we want

Research

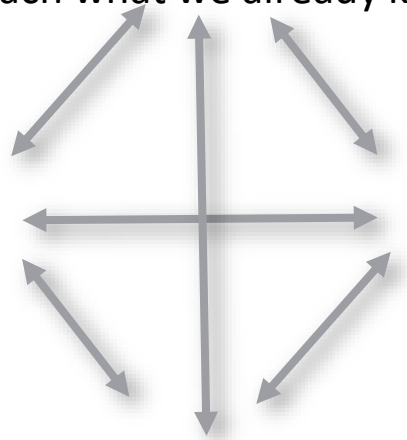
Learn new things nobody knew

Academia

STEM

Education

Teach what we already know



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DYALOG ^ Academia

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GOAL

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Promote and improve the use of Dyalog APL in academic environments

DYALOG ^ Academia

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- Get visibility in academic and research environments

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DYALOG ^ Academia

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- Introduce a new generation to APL

DYALOG ^ Academia

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- Learn about them and from them
- Study and improve the use of APL as a tool for education and research of technical topics
- Introduce a new generation to APL
- Establish fruitful relationships with the academic world

DYALOG ^ Academia

HOW

DYALOG ^ Academia

HOW

Work together with academia to solve difficult research problems and take part in education

DYALOG ^ GHENT UNIVERSITY

HOW

Work together with academia to solve difficult research problems and take part in education

- First, start working with a specific university

DYALOG ^ GHENT UNIVERSITY
Materials Science & Technology

HOW

Work together with academia to solve difficult research problems and take part in education

- First, start working with a specific university and a specific department

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Materials Science & Technology

HOW

Work together with academia to solve difficult research problems and take part in education

- First, start working with a specific university and a specific department
- Take part in academic life

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Materials Science & Technology

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- Apply APL to the solution of research problems

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Materials Science & Technology

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- Participate in research projects and education

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Materials Science & Technology

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Materials Science & Technology

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- Teach APL to students and researchers
- Establish contacts for future collaboration

GHENT UNIVERSITY

ugent.be

GENT UNIVERSITEIT

Ghent (Belgium), since 1817

Almost 50k students and 15k staff members in 11 faculties

Research (more than 8000 publications each year)

Dare To Think

GHENT UNIVERSITY

Materials Science & Technology

Materials Science & Technology

Faculty of Engineering and Architecture

- Master, PhDs, postdocs
- Research (industry / academy)
  - Mechanical material behaviour
  - Physical metallurgy
  - Microstructural observations
  - Metals processing

mst.ugent.be

Materials Research Cluster Gent

Computational problems in Materials Science and Engineering

Computational problems in Materials Science and Engineering

Microstructural Analysis

Crystal Plasticity

Transformation Models

Computational problems in Materials Science and Engineering

Microstructural Analysis

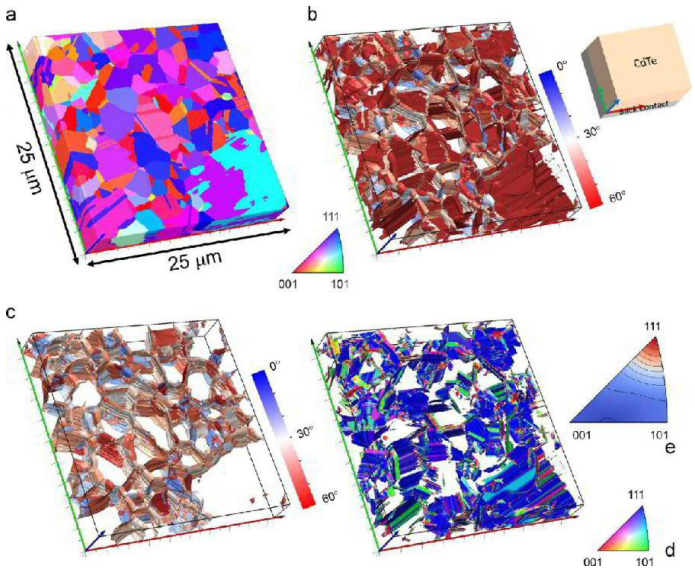
Large amounts of SEM/EBSD and simulation data (2D/3D)

Study properties, relationships, topology

Calculate distributions

Crystallographic texture analysis (boundaries, ODFs)

Bridge between simulations and experiments



dierk-raabe.com

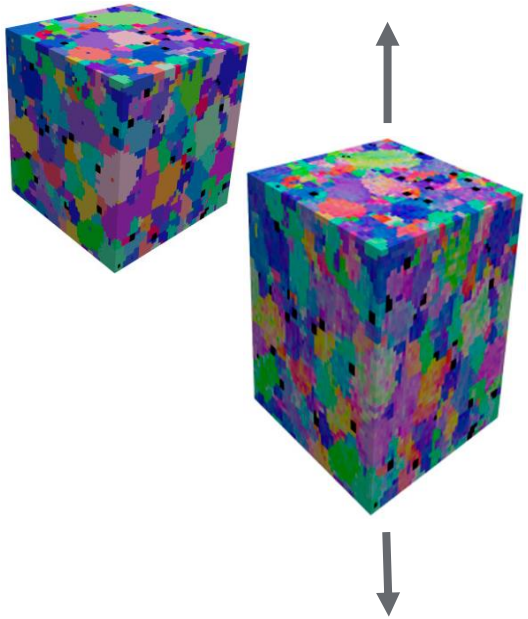
Computational problems in Materials Science and Engineering

Crystal Plasticity

Mesoscopic models of plastic deformation in polycrystalline materials

Materials science (crystallography) + mechanical engineering (tensor algebra) + HPC (days long simulations)

Mean Field, Finite-Element Method (CPFEM), Fast Fourier Transforms (CPFFT), …



doi.org/10.3390/cryst10090819

Computational problems in Materials Science and Engineering

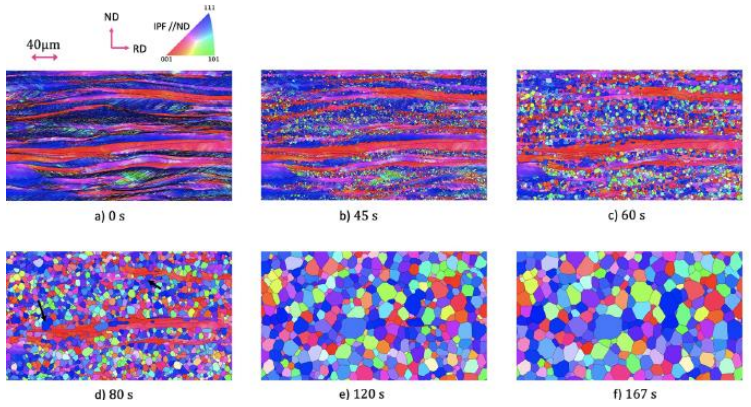
Transformation Models

Mesoscopic models of thermal processes in polycrystalline materials

- Phase transformations
- Recrystallization
- Solidification

Thermodynamics (energy)

Cellular Automata, Monte Carlo, Finite-Elements, Phase Field, …



doi.org/10.1016/j.commatsci.2021.110643

Computational problems in Materials Science and Engineering

Microstructural Analysis

Crystal Plasticity

Transformation Models

Computational problems in Materials Science and Engineering

Microstructural Analysis

Crystal Plasticity

Transformation Models

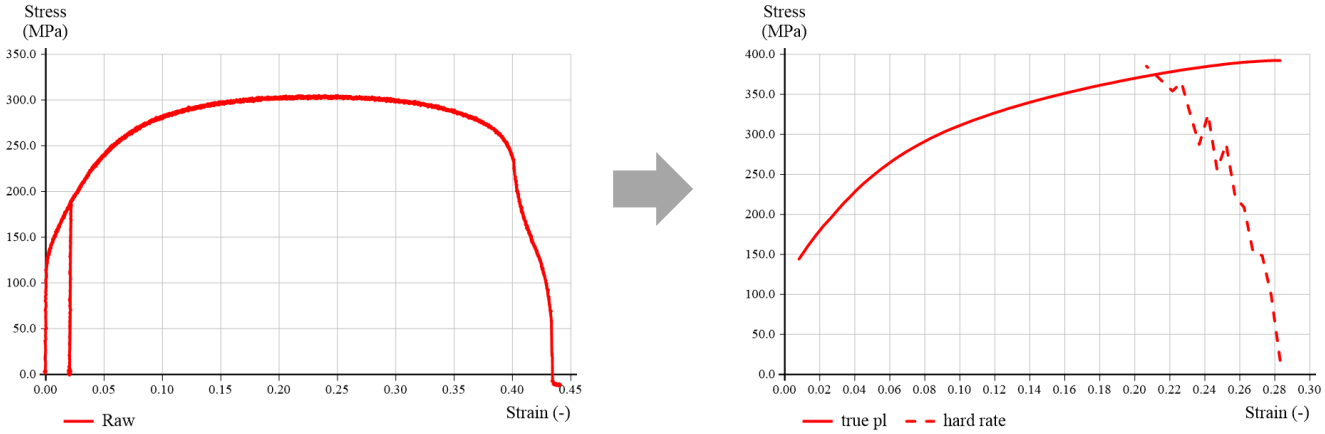
Analysis of tensile experiments

Analysis of tensile data

Typical example of workflow (and data):

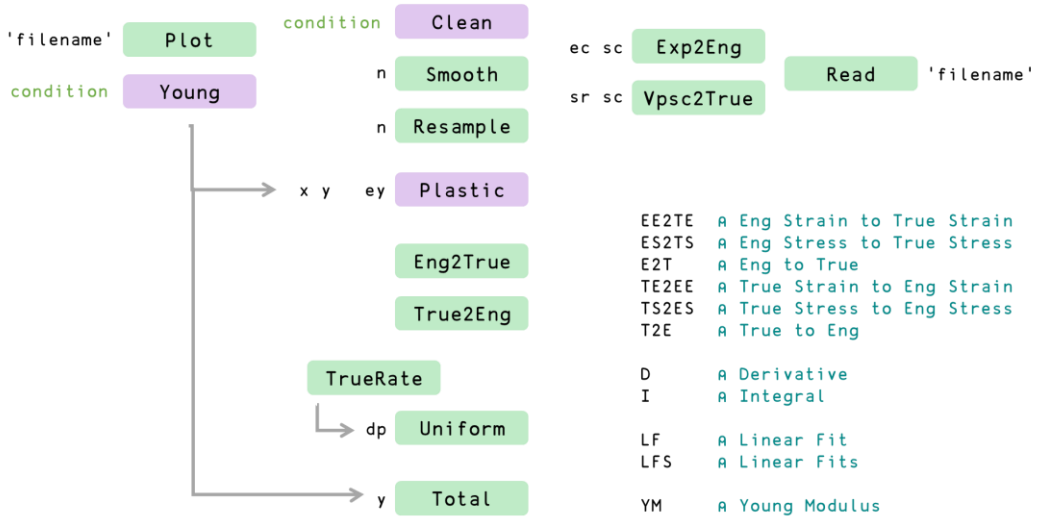
Read → Clean up → **Process** → Plot

- Filtering and smoothing of curves, derivatives and integrals, find properties



Computational problems in Materials Science and Engineering

Analysis of tensile data

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wc -l *.apl*
  4 Clean.aplo
 21 Demo.aplf
  1 Eng2True.aplf
  1 Exp2Eng.aplf
  1 PE.aplf
  4 Plastic.aplf
 41 Plot.aplf
  6 Read.aplf
  1 Resample.aplf
  1 Smooth.aplf
  3 Total.aplf
  1 True2Eng.aplf
  6 TrueRate.aplf
  1 UTS.aplf
  6 Uniform.aplf
  1 Vpsc2True.aplf
  1 YS.aplf
  4 Young.aplo
 21 fns.apln
125 total
```

^ Research

Materials Science & Technology

^ Research

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Use APL to solve interesting problems

- Data analysis (mechanical experiments, microstructures, texture)
- Modelling of thermo-mechanical processes

^ Research

Materials Science & Technology

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- Data analysis (mechanical experiments, microstructures, texture)
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Compare with previous solutions using other software and programming languages

^ Research

Materials Science & Technology

- Use APL to solve interesting problems
  - Data analysis (mechanical experiments, microstructures, texture)
  - Modelling of thermo-mechanical processes
- Compare with previous solutions using other software and programming languages
- More presence in research projects and scientific publications

^

Education

Materials Science & Technology

^ Education

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Use APL to teach / learn about complex topics

- Mathematical methods
- Crystallography and crystal plasticity
- Modelling of thermo-mechanical processes

^ Education

Materials Science & Technology

Use APL to teach / learn about complex topics

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Evaluate capacities of APL as a teaching tool when compared with mainstream languages

^ Education

Materials Science & Technology

Use APL to teach / learn about complex topics

- Mathematical methods
- Crystallography and crystal plasticity
- Modelling of thermo-mechanical processes

Evaluate capacities of APL as a teaching tool when compared with mainstream languages

More presence in the classroom and the student community

What can Dyalog learn from academy?

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Interesting – and hard! – problems that need to be solved (by domain experts)

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New and different workflows

What can Dyalog learn from academy?

Interesting – and hard! – problems that need to be solved (by domain experts)

New and different workflows

Participate in academic gatherings and publications (conferences, peer-review)

What can Dyalog learn from academy?

Interesting – and hard! – problems that need to be solved (by domain experts)

New and different workflows

Participate in academic gatherings and publications (conferences, peer-review)

Take part in research and innovation

Academia

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Thank you!

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