
SEVENTEENTH ANNUAL
BiTS
Burn-in & Test Strategies Workshop
March 6 - 9, 2016
Hilton Phoenix / Mesa Hotel
Mesa, Arizona
Archive- Session 3
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BiTS 2016 Burn-in & Test Strategies Workshop

Session 3
Morten Jensen
Session Chair

BiTS Workshop 2016 Schedule

Frontiers Day

Monday March 7 - 4:30 pm

Stimulating Simulating

"Optimizing the PCB-to-socket-to-DUT interface"

Gert Hohenwarter - GateWave Northern, Inc.

"Characterize Only the High Speed Interconnect Performance"

Carol McCuen - R&D Altanova

"Modelling, Materials, and Madness"

Mike Gedeon - Materion

BiTS 2016 Burn-in & Test Strategies Workshop

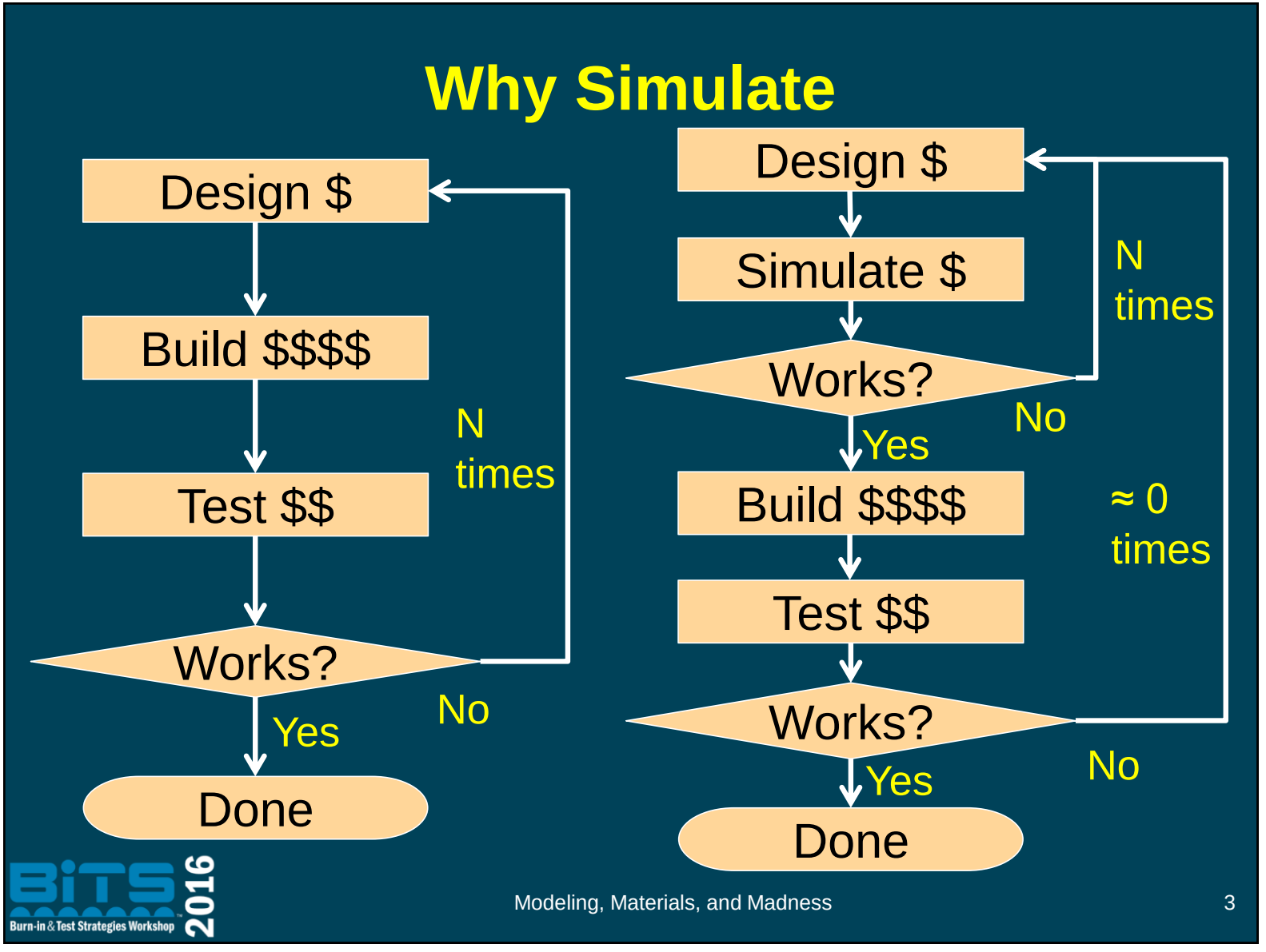
Modeling, Materials, and Madness

Mike Gedeon
Materion

2016 BiTS Workshop
March 6 - 9, 2016

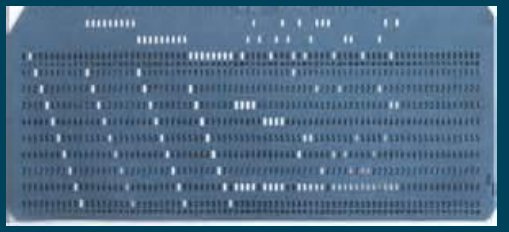
Computer Simulation

- FEA (Finite Element Analysis)
- CFD (Computational Fluid Dynamics)
- BEM (Boundary Element Method)
- SPICE (Simulation Program with Integrated Circuit Emphasis)
- And many, many more…


Why Simulate
Design $
Build $$$$
Test $$
Works?
N times
No
Yes
Done
Design $
Simulate $
Works?
N times
No
Yes
Build $$$$
≈ 0 times
Test $$
Works?
No
Yes
Done
Modeling, Materials, and Madness
3

Simulation – The Early Days

Input / Output Device



Typical User Interface

Typical Users

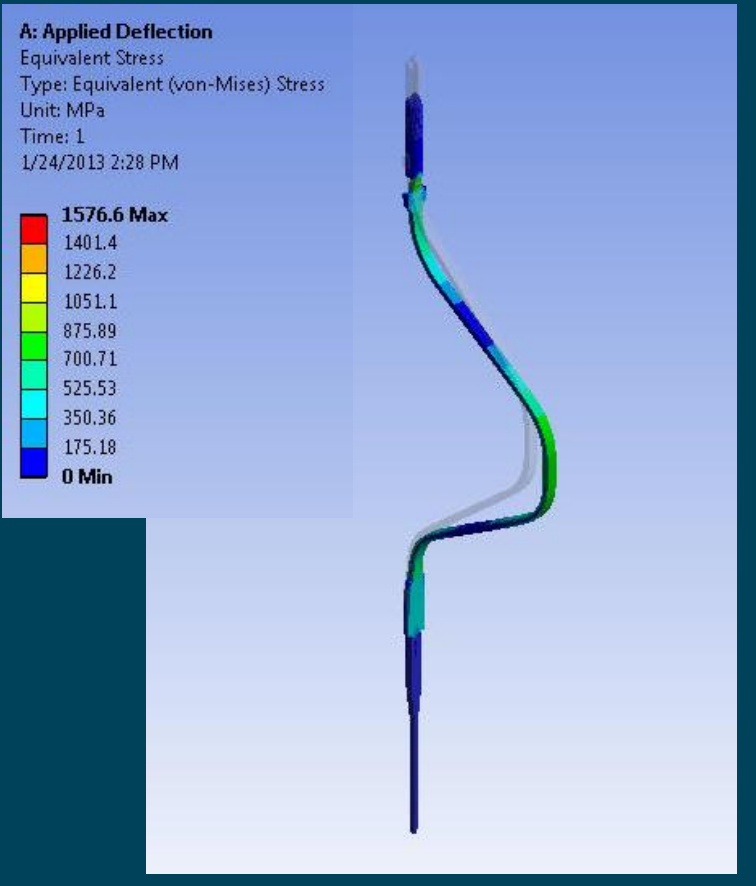
Typical System

Simulation – Today

Simulation

Benefits

- Almost anyone can do it
- Produces convincing graphics
- Can increase your confidence of reliability



Simulation

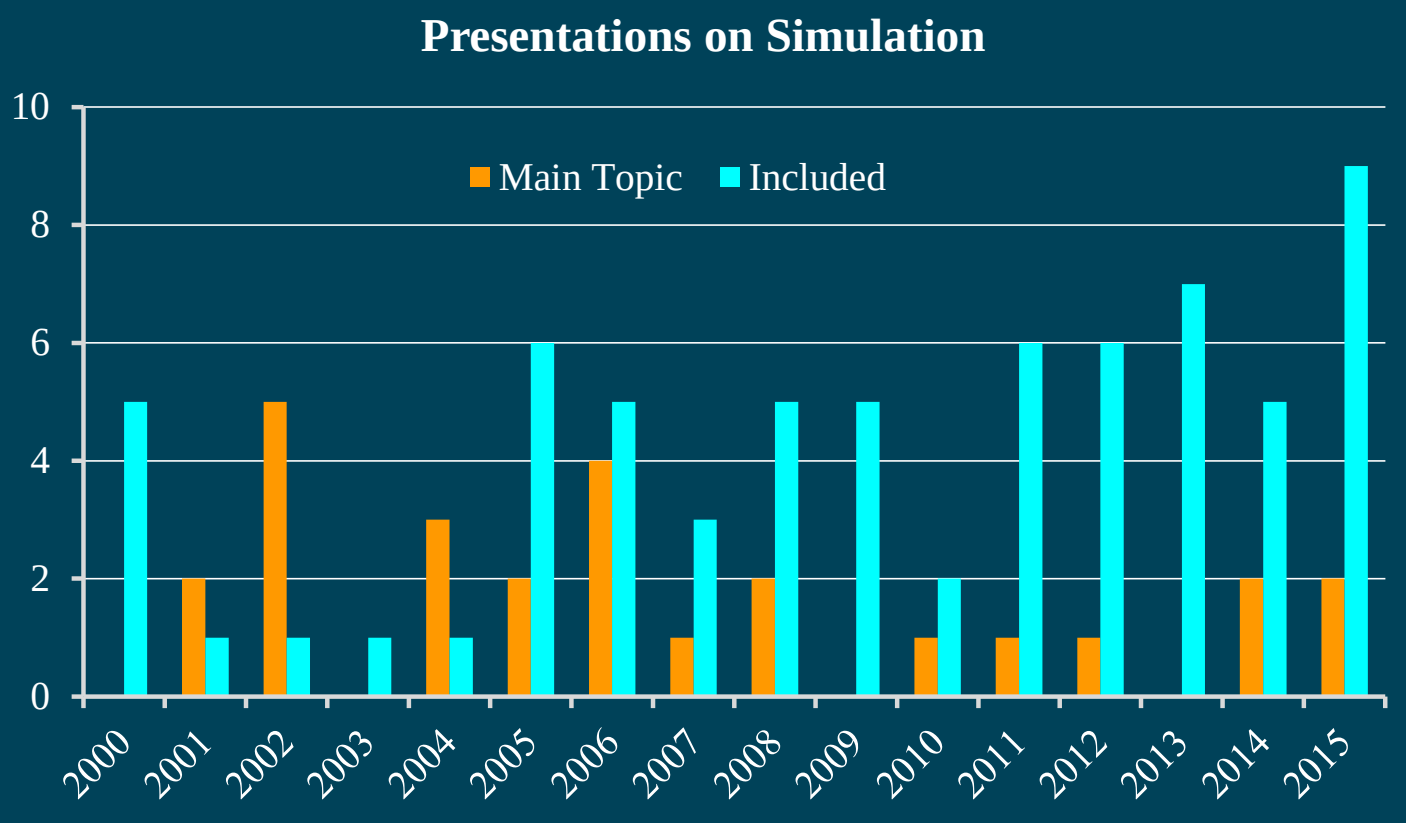
Benefits

- Almost anyone can do it
- Produces convincing graphics
- Can increase your confidence of reliability

Disadvantages

- Almost anyone can do it
- Produces convincing graphics
- Can increase your confidence of reliability

A History of Simulation at BiTS



Modeling, Materials, and Madness

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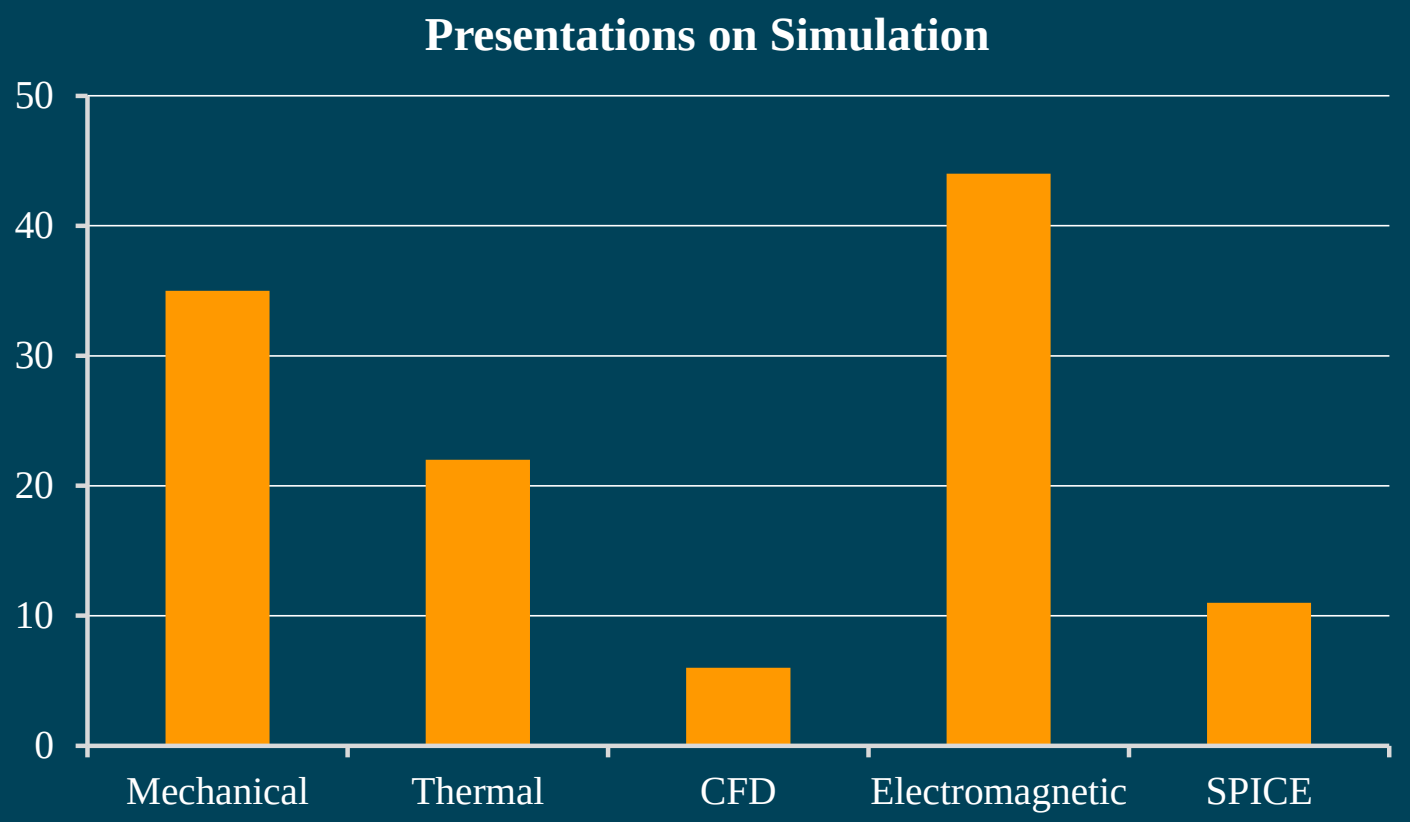
A History of Simulation at BiTS



Simulation has Appeared in

- 78 Papers
- 4 Hot Topics Papers
- 2 Supplemental Papers
- 2 Tutorials
- 3 Posters
- 1 Panel Discussion
- 1 Invited Speaker Presentation
- 1 Tech Talk
- 1 Marketplace Report
- 1 Keynote Address

BiTS 2004

FEA Analysis of a Burn-in Socket Contact - Beware the use of Simple Models.

Prasanth Ambady, Ray Mandeville and James Forster

Texas Instruments,
Sensors & Controls, Attleboro, MA

2004 Burn-in Test Socket Workshop - March 7-10, 2004
Hilton Phoenix East/Mesa Hotel
Mesa, Arizona

TEXAS INSTRUMENTS

BiTS BURN-IN & TEST SOCKET WORKSHOP

Beware the Use of Simple Models – BiTS 2004

- FEA is a tool which has revolutionized the world of design
- Care must be exercised to ensure that the results are meaningful
- Garbage in – Garbage out.
- Our understanding is imperfect - mistakes will still happen.
- Attempt to verify predications whenever possible.
- "It is difficult for outsiders to assess whether FEA work is being done effectively".
  - Peter Budgell (FEA Consultant)

BiTS 2006

Sources of Variation and Error in Finite Element Analysis

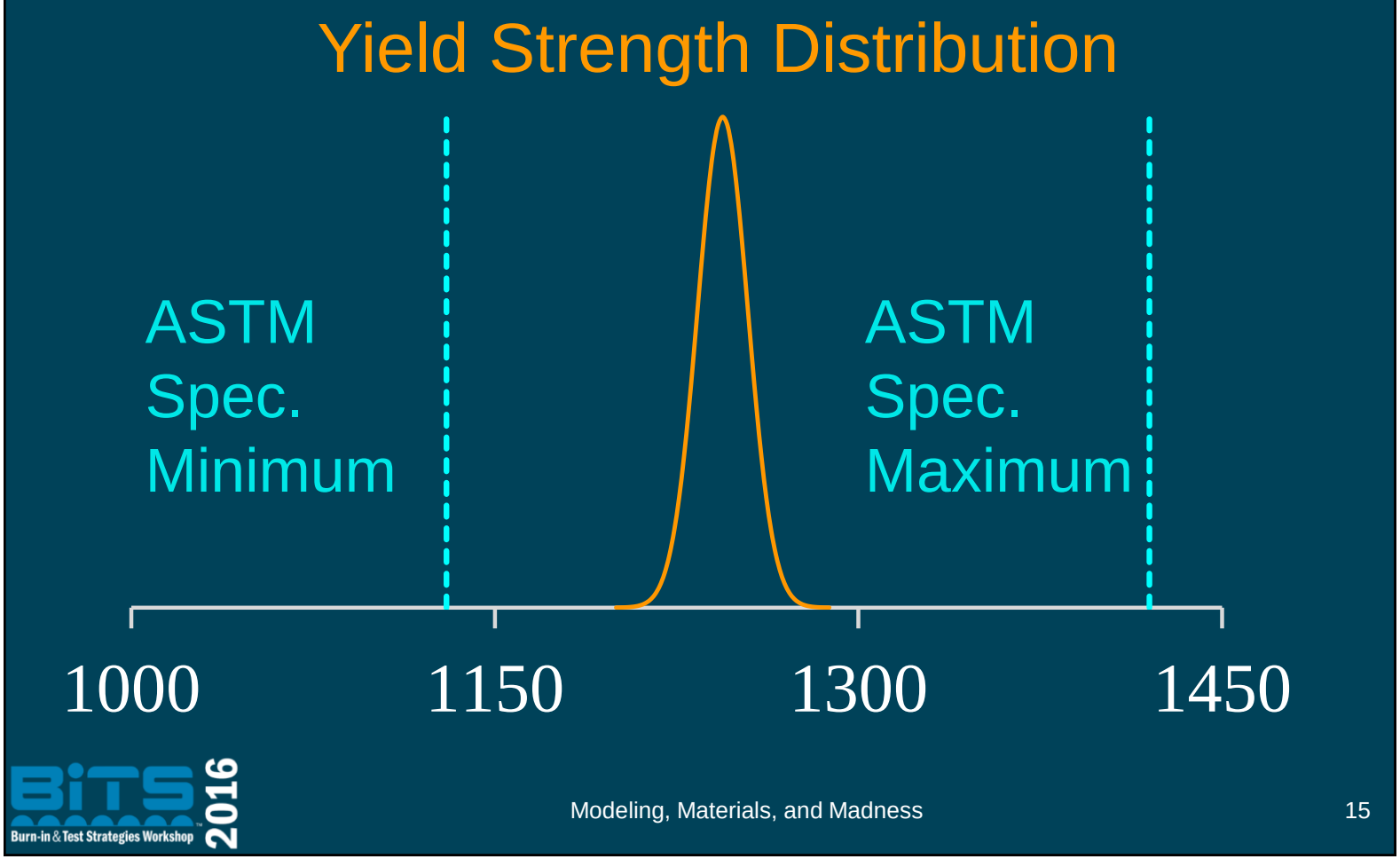
2006 Burn-in and Test Socket Workshop
March 12 - 15, 2006

Mike Gedeon
Brush Wellman Inc.

Sources of Variation and Error in FEA - BiTS 2006

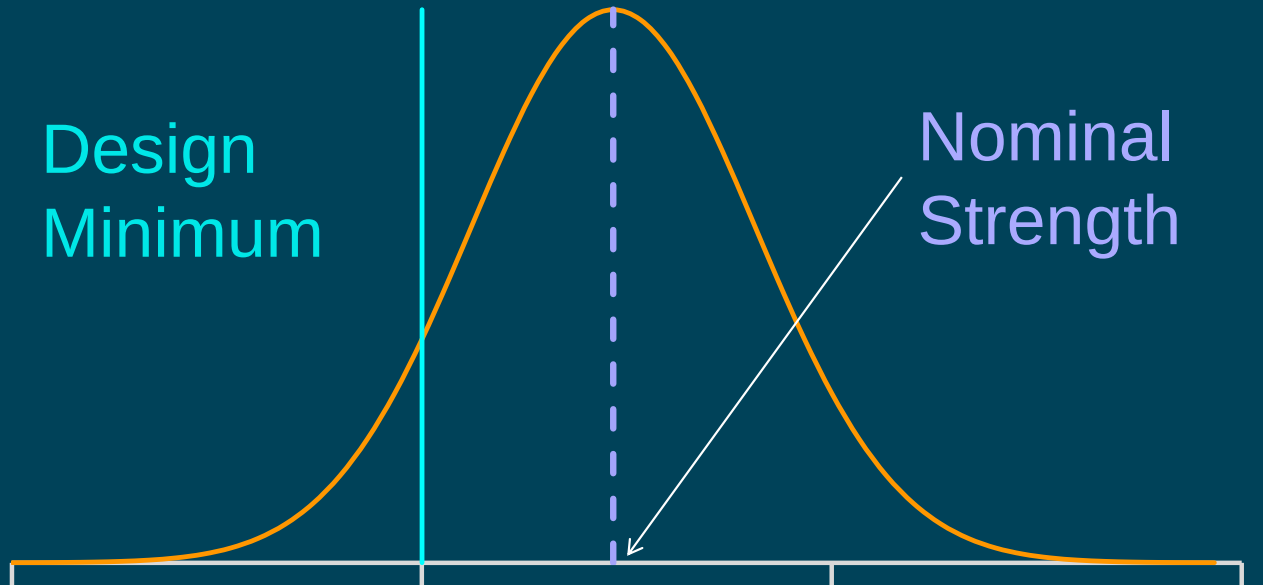
- Oversimplification of model
- Element type/size
- Nonlinearities
- Definition of boundary/initial conditions
- Frictional effects
- Stiffness singularities
- Dimensional tolerances
- Property variation
- Residual stresses
- Edge condition/ cross-section uniformity

Know Your Spec's and Stats



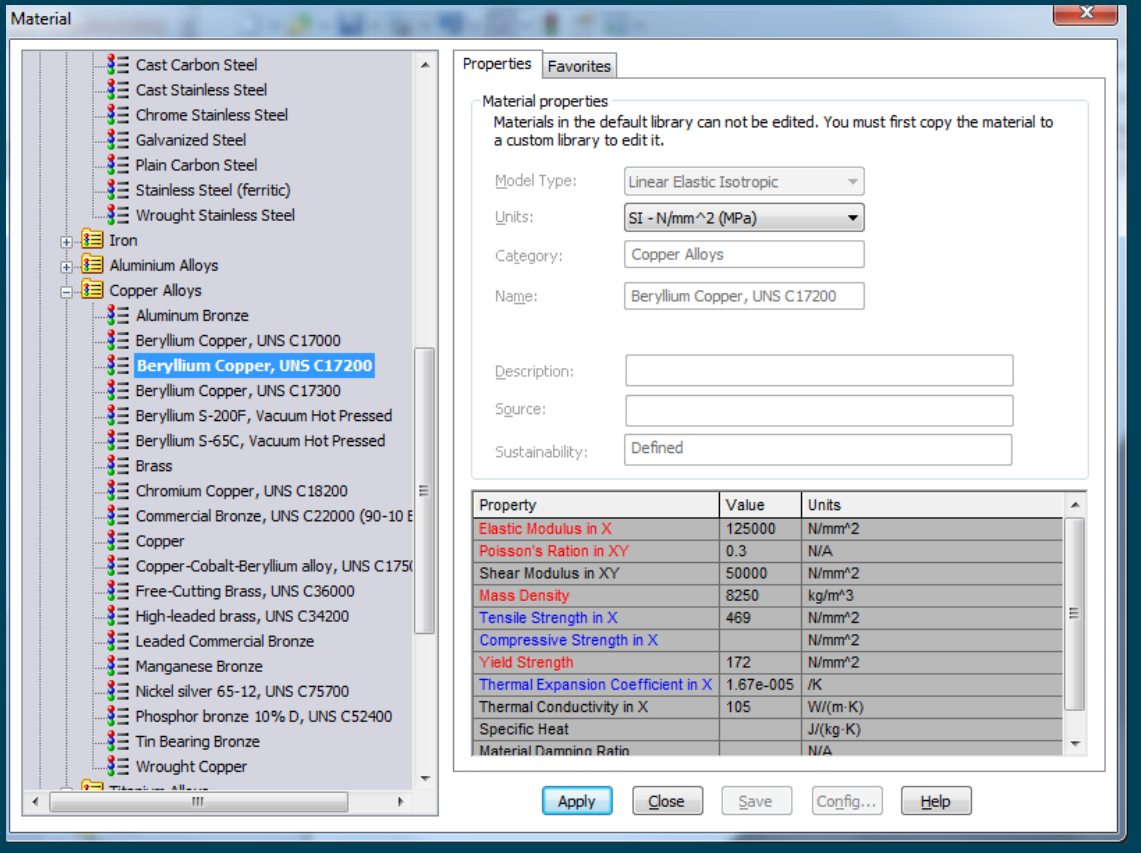
Problem!

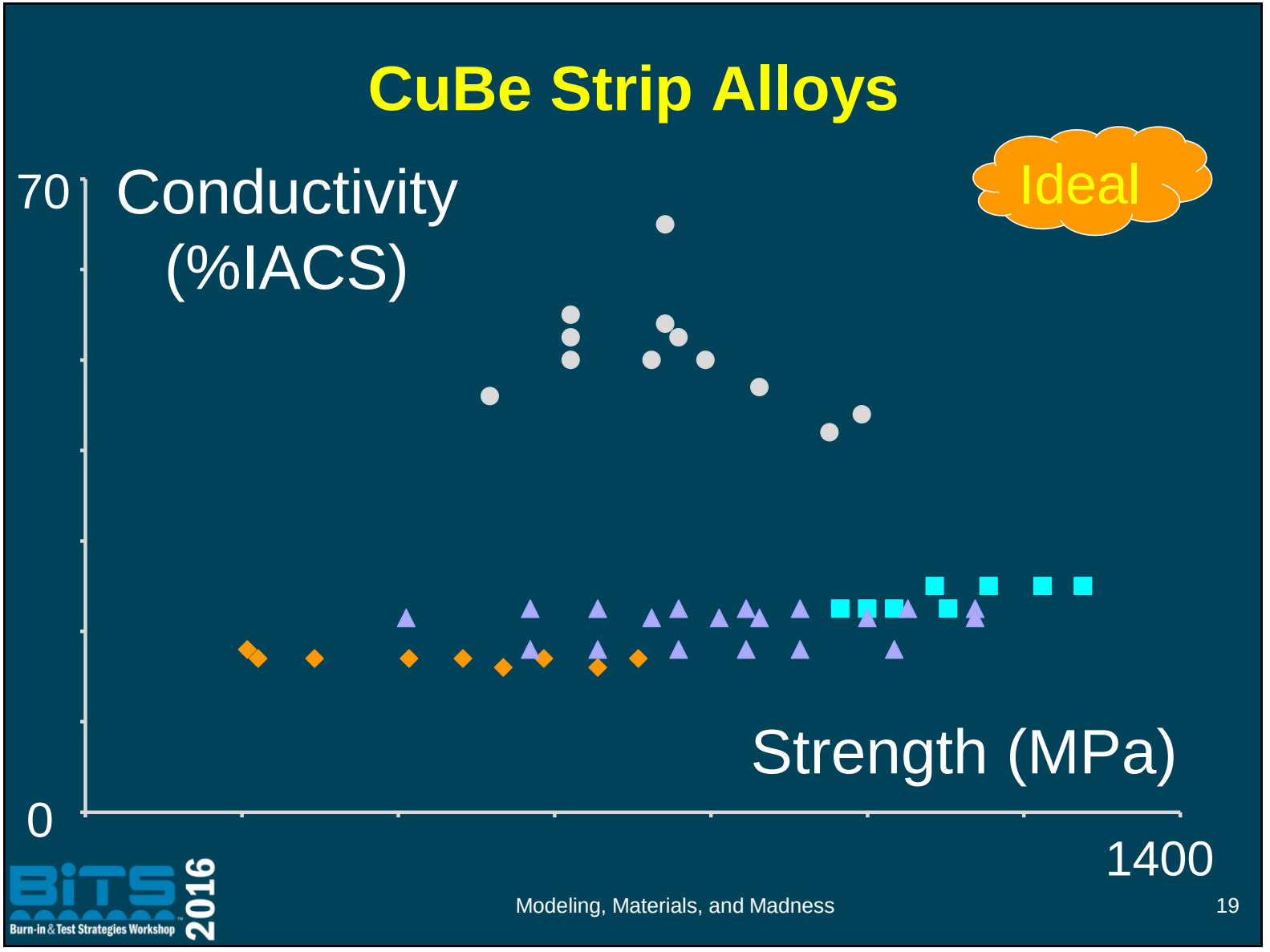
Yield Strength Distribution



Remember

Using Handbook/Library Data




CuBe Strip Alloys
Ideal
70
Conductivity
(%IACS)
0
Strength (MPa)
1400
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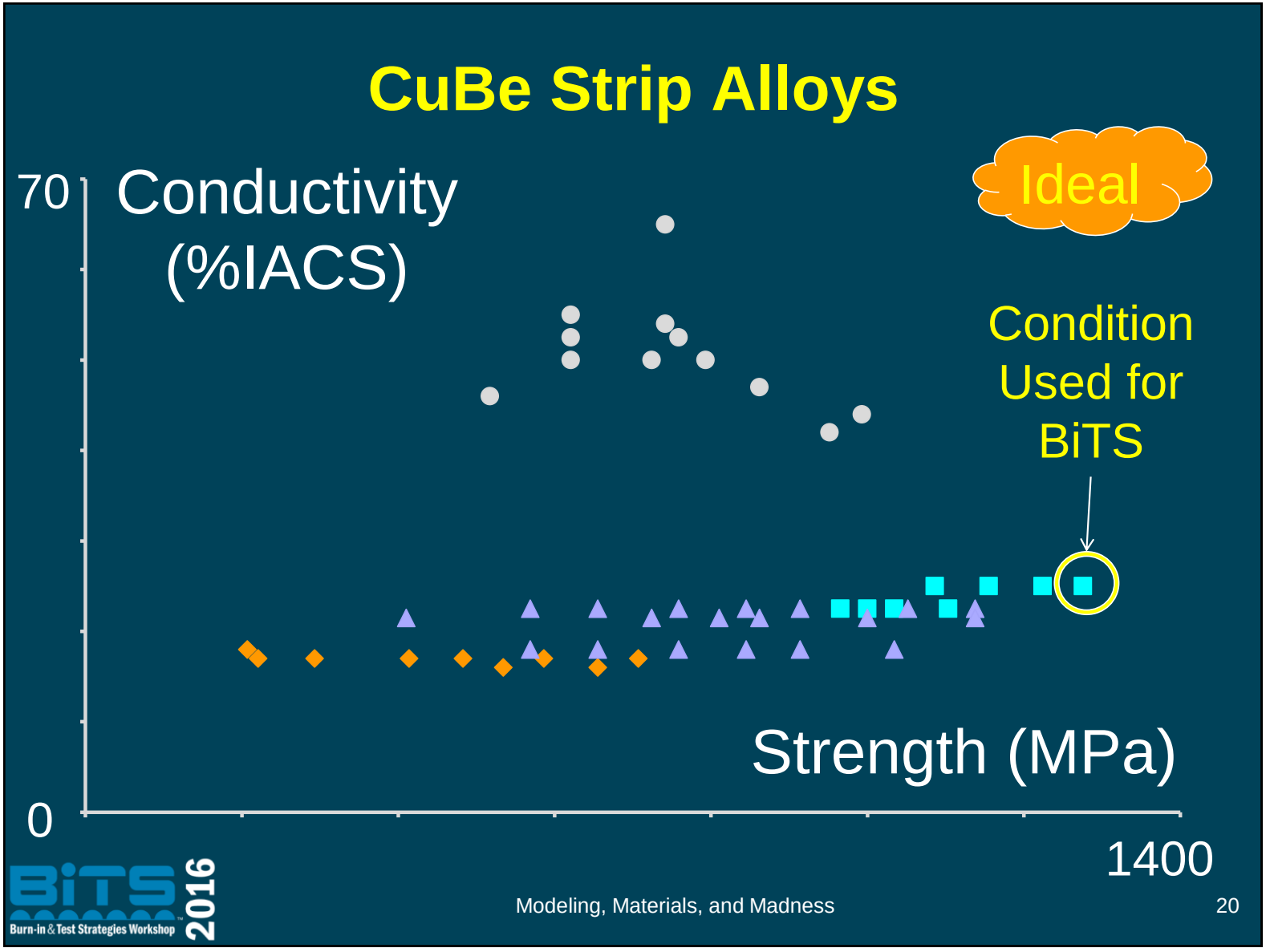
CuBe Strip Alloys
70
Conductivity
(%IACS)
Ideal
Condition
Used for
BiTS
Strength (MPa)
0
1400
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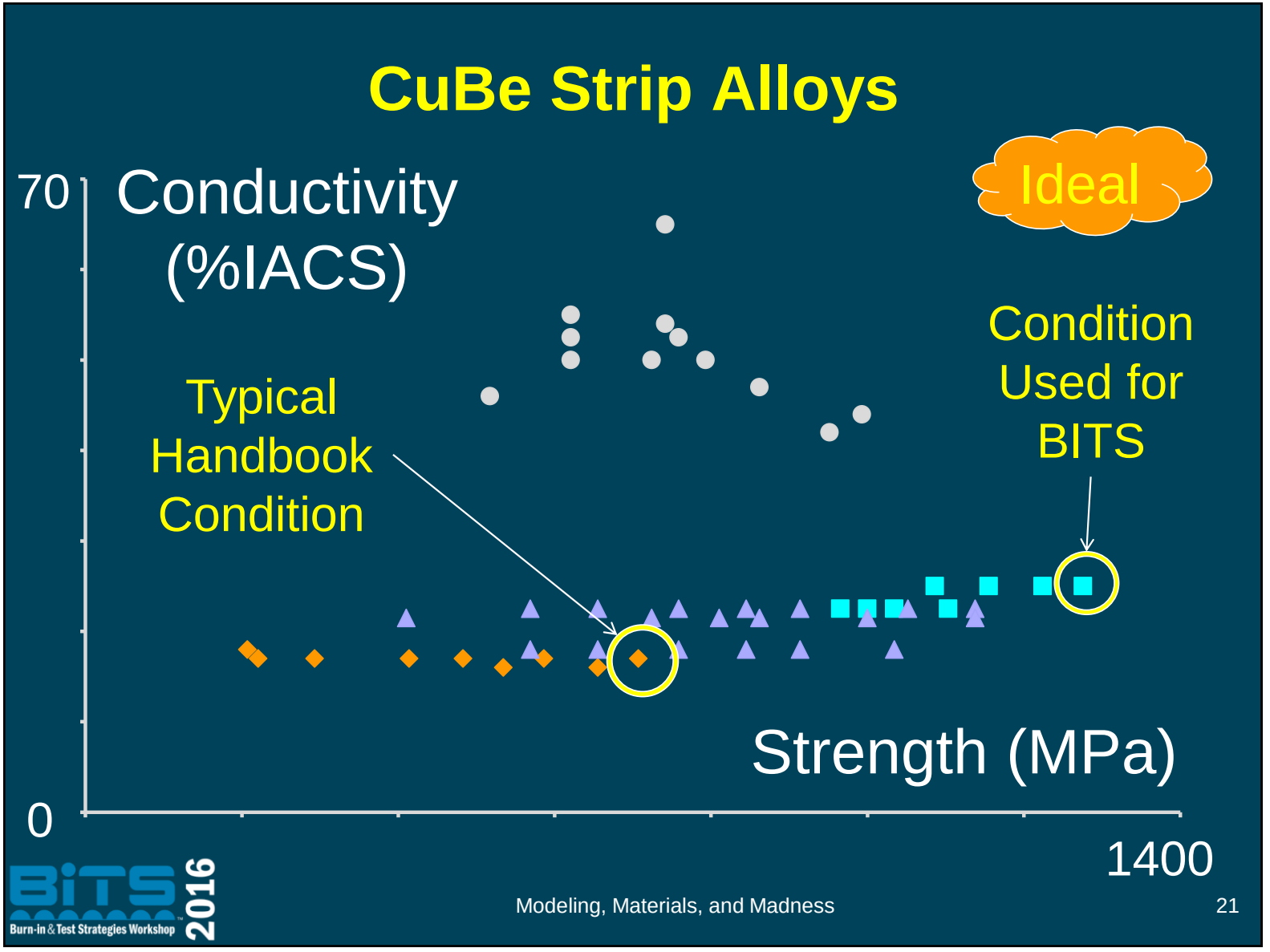
CuBe Strip Alloys
70
Conductivity
(%IACS)
Ideal
Condition
Used for
BITS
Typical
Handbook
Condition
Strength (MPa)
0
1400
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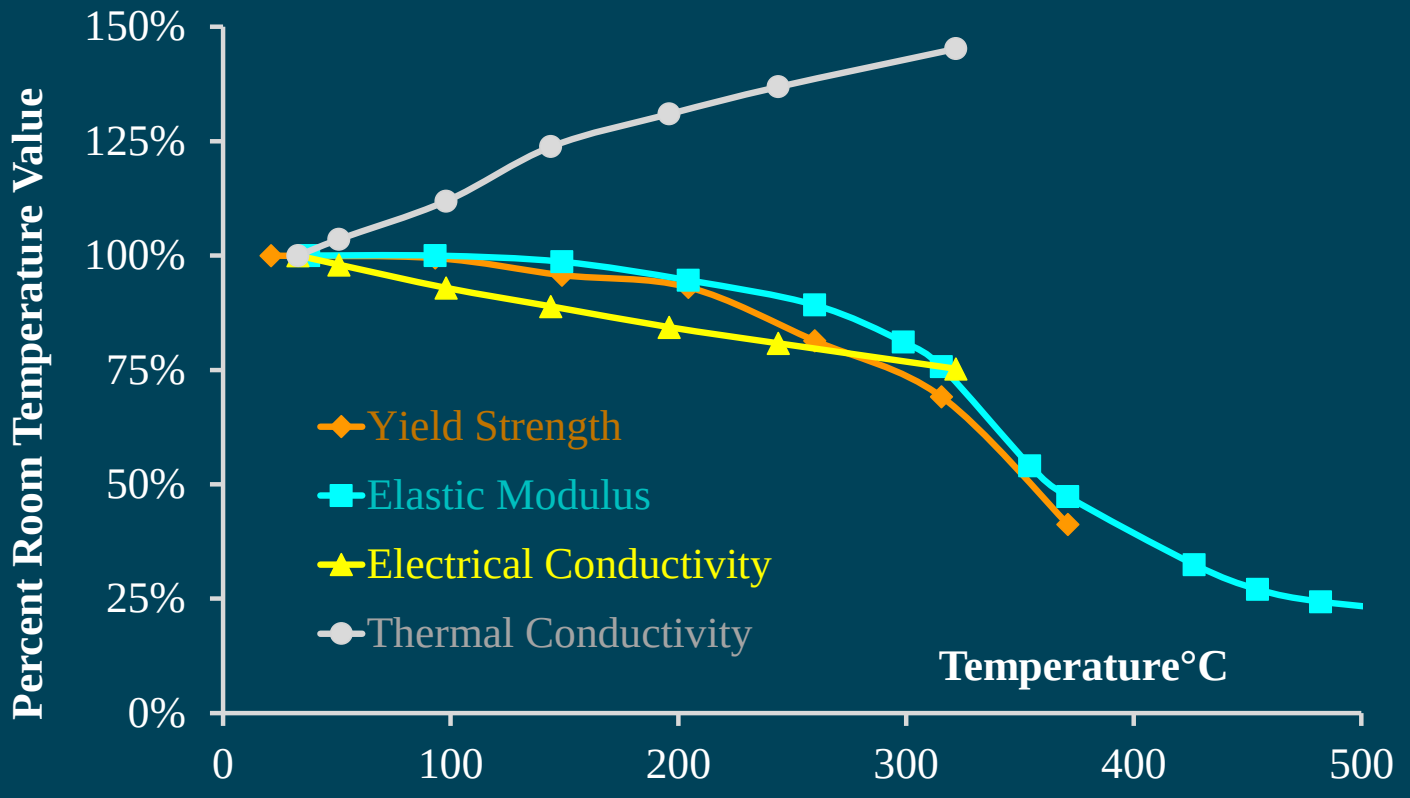
Using Handbook/Library Data

You're expecting this:

You may only have this:

Material Variation with Temperature



Types of Properties

Material Properties

- Known/measurable for each material
- Physical, mechanical, electrical, thermal, etc.

System Properties

- Combination of properties, loading & environmental conditions
- Coefficient of friction, contact resistance, etc.

Variation of Material Properties

- Material properties may be functions of
  - Temperature (Strength, Conductivity, Specific Heat, Toughness)
  - Strain Rate (Strength, Toughness)
  - Electric Field Strength (Permittivity)
  - Magnetic Field Strength (Permeability)
  - Pressure (Melting/Freezing Temperature)
  - Frequency (Dielectric Constant)
  - Time (Stress Relaxation)

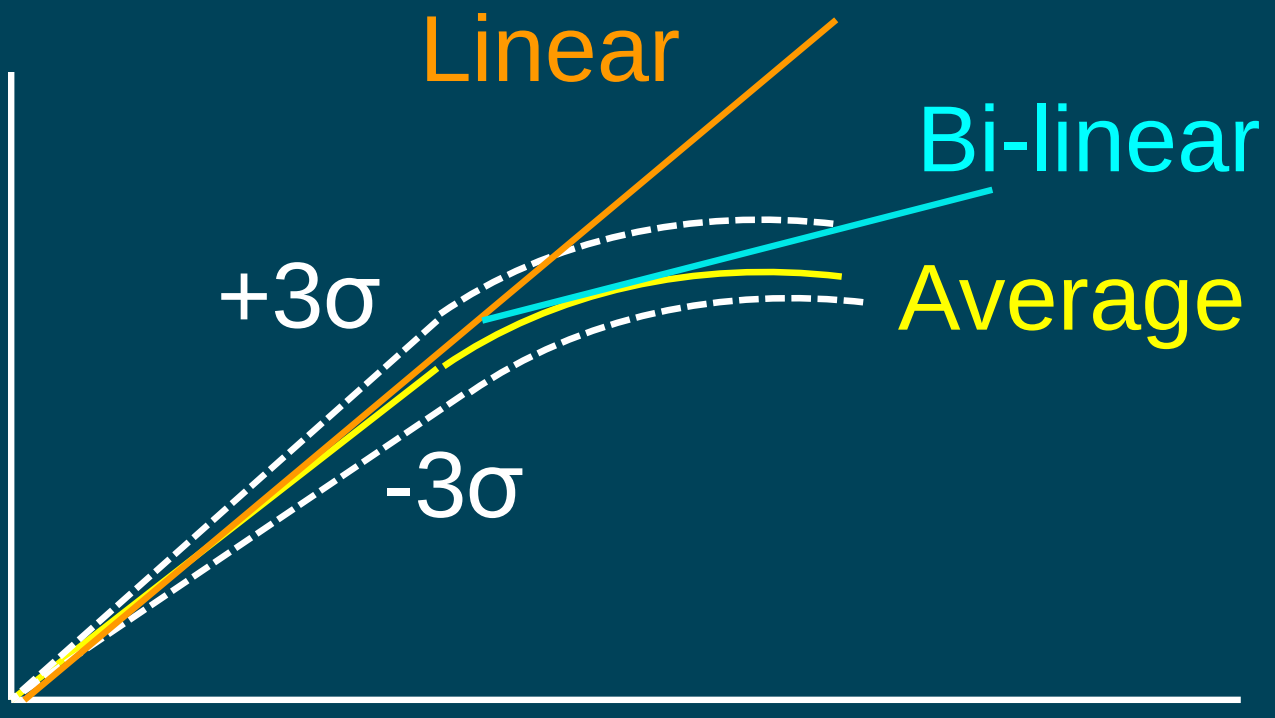
Variation of System Properties (1)

- System properties may be functions of
  - Contact Force (Friction, Contact Resistance)
  - Surface Roughness (Friction, Dielectric Constant)
  - Velocity (Friction)
  - Surface Coatings and Contamination (Contact Resistance, Friction)
  - Environmental Conditions (Contact Resistance, Friction)
  - Time (Contact Resistance)

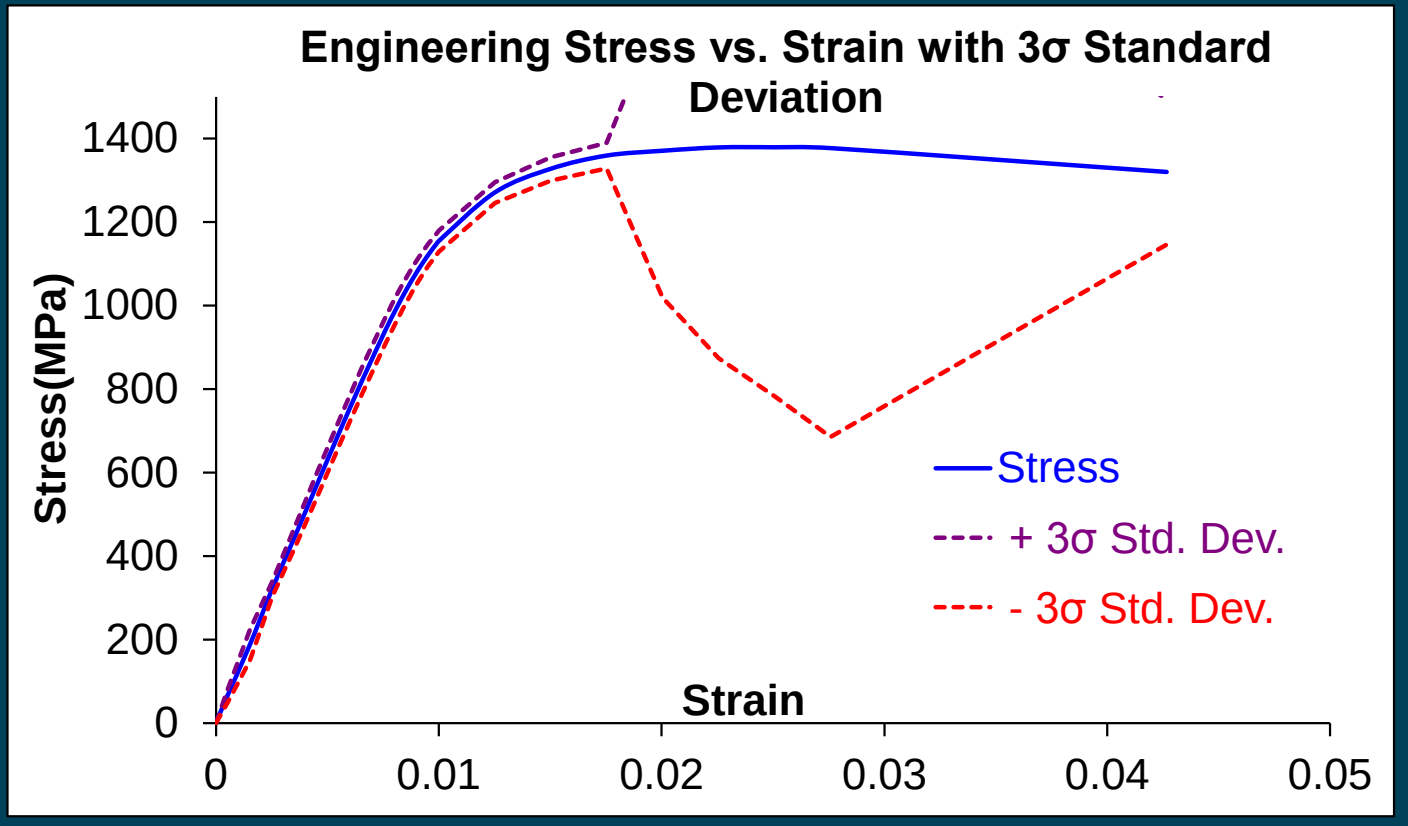
Variation of System Properties (2)

- System properties may be functions of
  - Distance (Capacitance)
  - Length (Resistance, Inductance)
  - Surface Area (Capacitance)
  - Hardness (Wear, Friction, Contact Resistance)
  - Temperature (Contact Resistance)
- Complex Interactions and Confounding!

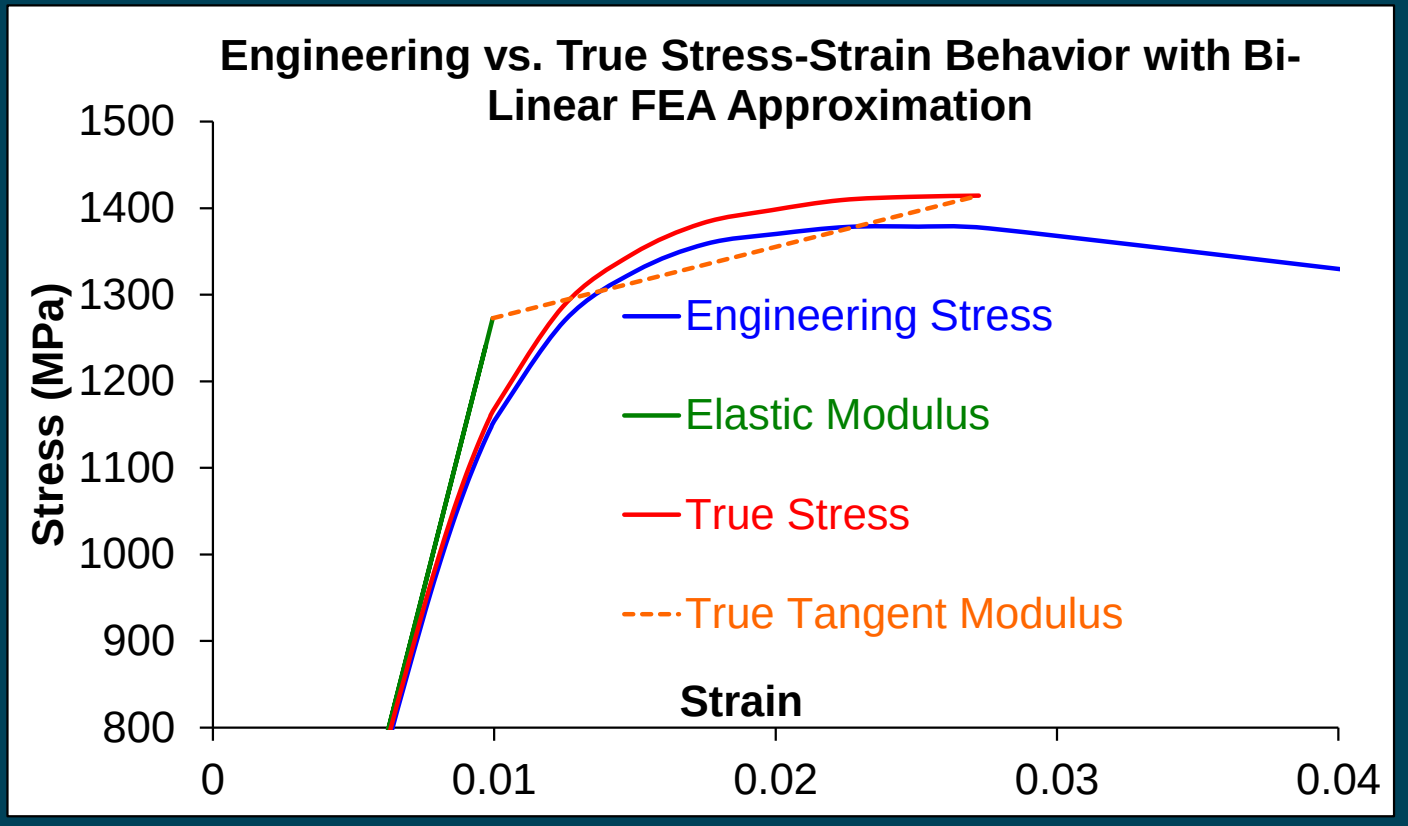
FEA Stress-Strain Behaviors



Variation of Material Properties



Variation of Material Properties



Simulation

- Simulation can be a very powerful tool - when used properly

- But, remember…

It's Only a Model.