iLogic | Nastran Automation

Manufacturing & Product Design

PRESENTER: **CHRIS ATHERTON**

*UK Consulting Services Manager | **Symetri***

Join the conversation #AUCity #AU2019

SYMETRI
ADDNODE GROUP

AUTODESK
UNIVERSITY

Chris Atherton

UK Consultancy Services Manager | Symetri

- Based in Skipton – UK

- Main focuses in Design Automation, Data Management, Business Processes, Lean Solutions

- Inventor, Vault, AutoCAD ~ 15yrs

- BEng (Hons) Aerospace Engineering

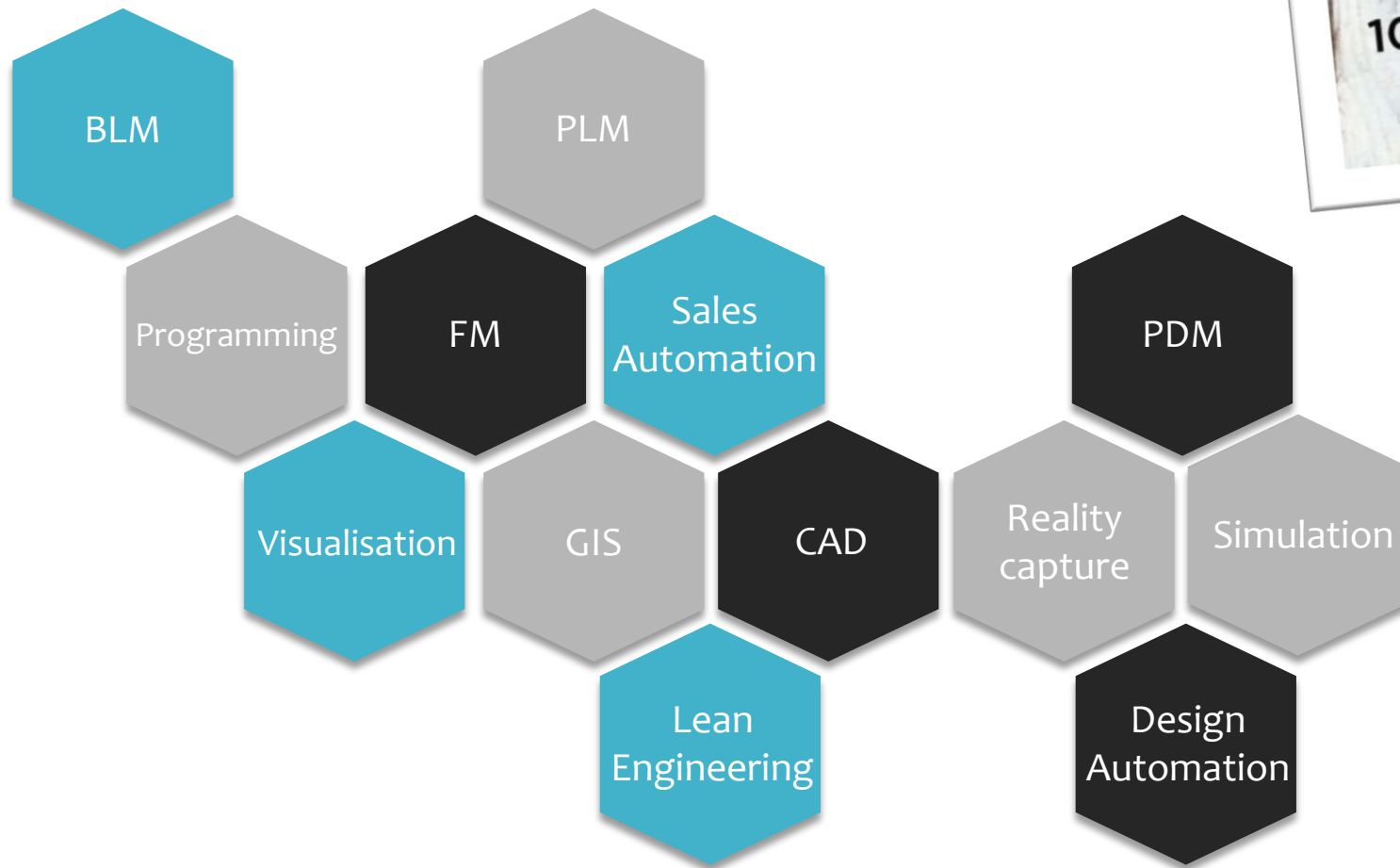- Incorporated Engineer IEng iMechE

EMAIL: CHRIS.ATHERTON@SYMETRI.COM

LinkedIn: linkedin.com/in/chrissoathe

TWITTER: @CHRISSOATHE @SYMETRIMFG

SYMETRI
ADDNODE GROUP

Symetri Solutions

300 EMPLOYEES
100.000 USERS

BLM

PLM

Programming

FM

Sales Automation

Visualisation

GIS

CAD

Lean Engineering

PDM

Reality capture

Simulation

Design Automation

"We challenge people to **work smarter** for a better future"

Jens Kollserud | CEO Symetri

http://info.symetri.com/autodesk-university-2019
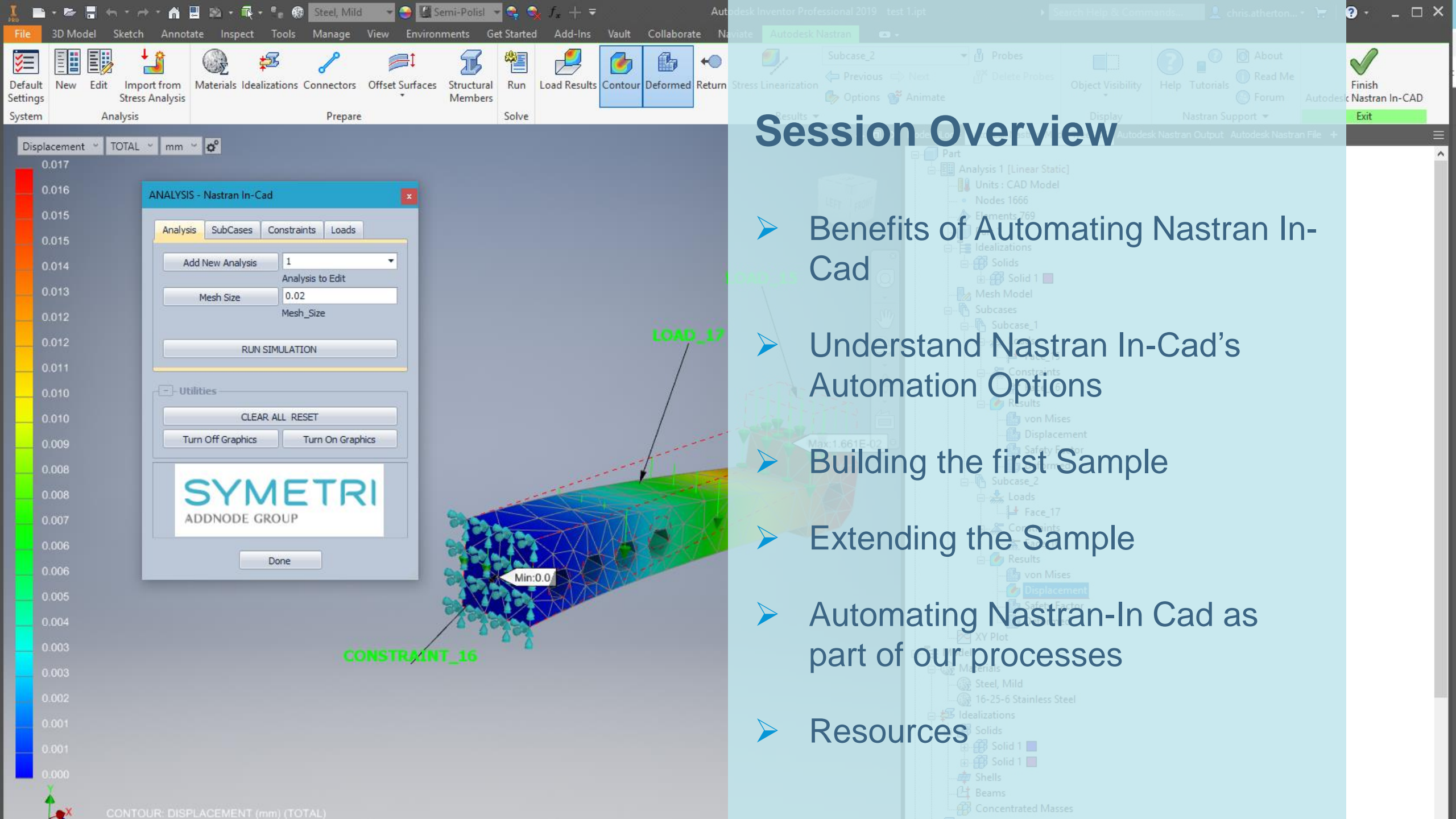
"The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency.

The second is that automation applied to an inefficient operation will magnify the inefficiency."

Bill Gates

Session Overview

➢ Benefits of Automating Nastran In-Cad

➢ Understand Nastran In-Cad's Automation Options

➢ Building the first Sample

➢ Extending the Sample

➢ Automating Nastran-In Cad as part of our processes

➢ Resources

Disclaimers

➢ We can't cover everything possible in 1 hr

➢ There are lots of methods to detail models you can use, this is a sample of one of them

➢ The code used here is a sample and will need tweaked for different situations

➢ What works now may need to be adapted in future as the technology changes

➢ The key to iLogic is know your processes and how you want to use the model.

Automating Nastran In-Cad

Why?

Why?

Requirements:

- •– Sign off Documentation
- •– Customer Documentation
- •– Traceability Documentation

Validation

Compliance

Repeatable

Why Not!

Compliance Risk

Dark Art

Democratise Simulation

Automating Nastran In-Cad
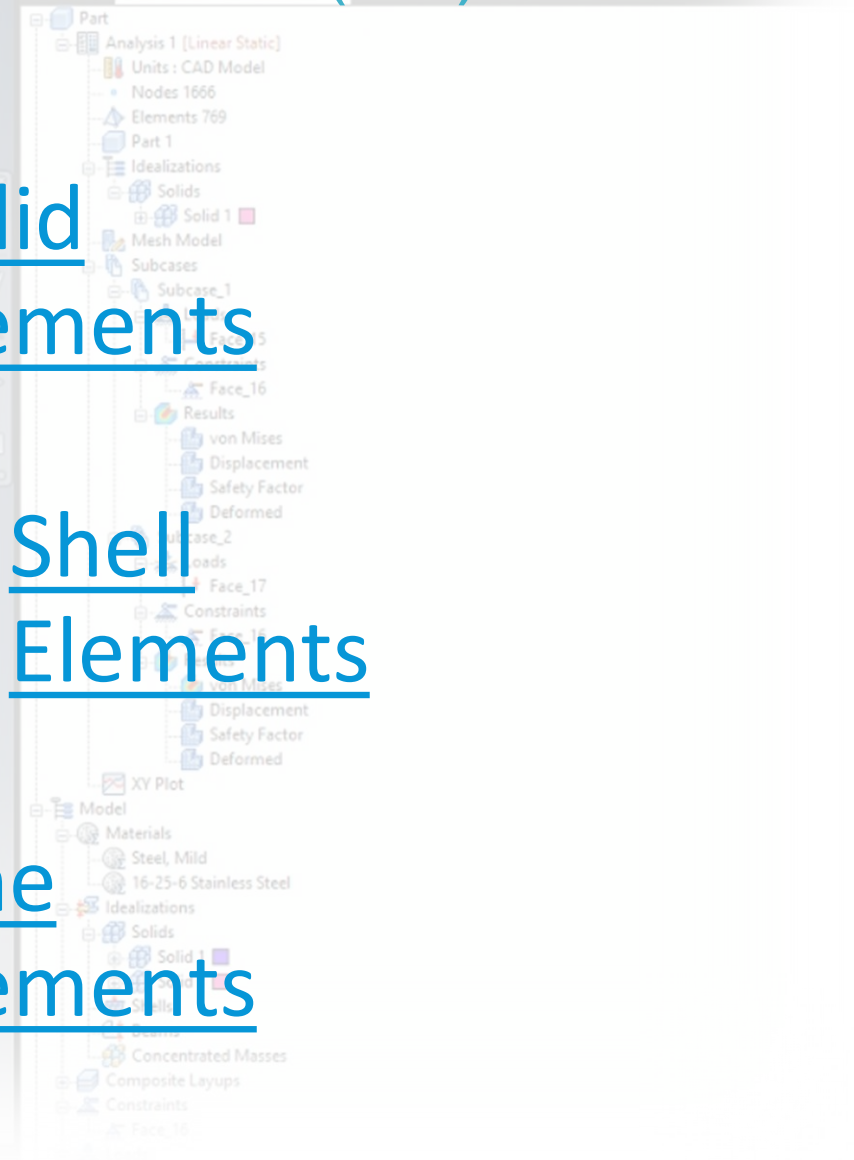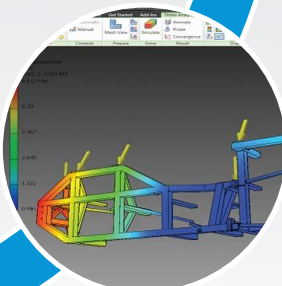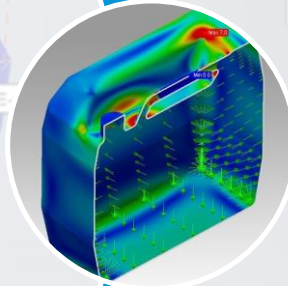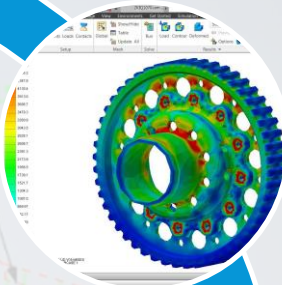
The Options?

Nastran In-CAD iLogic Automation (IIA)

Linear Static Analysis

[Solid Elements](#)

[Shell Elements](#)

[Line Elements](#)

Key Terms

Analysis
- Consist of Subcases, Materials, Mesh sizes

Sub Case
- Consist of Loads, Constraints, and Results

Idealisation
- Where all element physical properties are grouped: Solids | Shells | Beams

Mesh
- Options for Mesh size and shape

Loads
- Create forces on Faces

Constraints
- Create Conditions on Faces

Documented Commands

Delete Material	• Use the DeleteMaterial command to delete a single material.
Add Material	• Use the NewMaterial command to add a new material.
Delete Idealization	• Use the DeleteIdealization command to delete a single idealization.
Add Idealization	• Use the NewIdealization command to add a new idealization.
Mesh Model	• Use the MeshModel command to define a mesh without midside nodes.
Generate Mesh	• Use the GenerateMesh command to create the mesh.
Create Load	• Use the Load command to create a new load.
Create Constraint	• Use the strCmdForConstraint command to create a new constraint.
Run Analysis	• Use the strCmdForSolve command to run the analysis.
Display Contour Plot	• Show plot after the analysis has run

New 2020 Commands

New Analysis	• Create a New Analysis
New Subcase	• Generate a new subcase
Delete Subcase	• Delete a Named Analysis
Delete Analysis	• Delete a Named Subcase

The Options?

- http://help.autodesk.com/view/NINCAD/2019/ENU/?guid=GUID-7F05F601-0369-41B0-BE0F-980A08B1BD06

- Change iLogic Addin DLLs Directory: *C:\Program Files\Autodesk\Nastran In-CAD 2019\System*

- *Rule called "Main" :*

- Setting iLogic External Rules directory to In-CAD's iLogic external rules folder.

- Setting iLogic Addin DLLs directory (object of iLogic) to In-CAD's System folder.

```
Sub Main()
    Dim oIlogic As IiLogicAutomation
    oIlogic = iLogicVb.Automation

    ' Setting iLogic External Rules directory to In-CAD's iLogic external rules folder
    Dim ExternalRuleDirectory(0) As String
    ExternalRuleDirectory(0) = "C:\Program Files\Autodesk\Nastran In-CAD 2019\System\iLogic"
    oIlogic.FileOptions.ExternalRuleDirectories = ExternalRuleDirectory
    iLogicVb.RunExternalRule("IlogicExtRule_EnterInCADEnv")

    ' Setting iLogic Addin DLLs directory to In-CAD's System folder
    oIlogic.FileOptions.AddinDirectory = "C:\Program Files\Autodesk\Nastran In-CAD 2019\System"

End Sub
```

Automating Nastran In-Cad

My First Sample?

Samples

- Linear Static Analysis

    - https://knowledge.autodesk.com/support/inventor-nastran/getting-started/caas/CloudHelp/cloudhelp/2019/ENU/NINCAD-Tutorials/files/GUID-B4853552-422A-4A93-8B99-64CD2A6EAC50-htm.html

- Gravity Load on an Aluminium Frame

    - https://knowledge.autodesk.com/support/inventor-nastran/getting-started/caas/CloudHelp/cloudhelp/2019/ENU/NINCAD-Tutorials/files/GUID-8CFC8837-7BD3-476A-90C5-A131D88E3811-htm.html

TRAINING

TEACHING

KNOWLEDGE

DEVELOPMENT

COACHING

LEARN NEW SKILLS

Lets Take a look ...

ANALYSIS - Nastran In-Cad

Analysis | SubCases | Constraints | Loads

Add New Analysis | 1

Analysis to Edit

Mesh Size | 0.02

Mesh_Size

RUN SIMULATION

CLEAR ALL RESET

Turn Off Graphics | Turn On Graphics

LOAD_17

Min: 2.136E-03

Max: 18.04

SYMETRI
ADDNODE GROUP

Done

Mesh Model
Subcases
Subcase_1
Loads
Face_15
Constraints
Face_16
Results
von Mises
Displacement
Safety Factor
Deformed
Subcase_2
Loads
Face_17
Constraints
Face_16
Results
von Mises
Displacement
Safety Factor
Deformed
XY Plot
Model
Materials

SYMETRI
ADDNODE GROUP

The API …

Its not that terrifying honest!

API Help And Samples

- This is the route map to do what you want!
  - One big tree diagram!

- Much of the theory is explained within the help

- My first plugin

- Samples in VBA code easily manipulated to .net
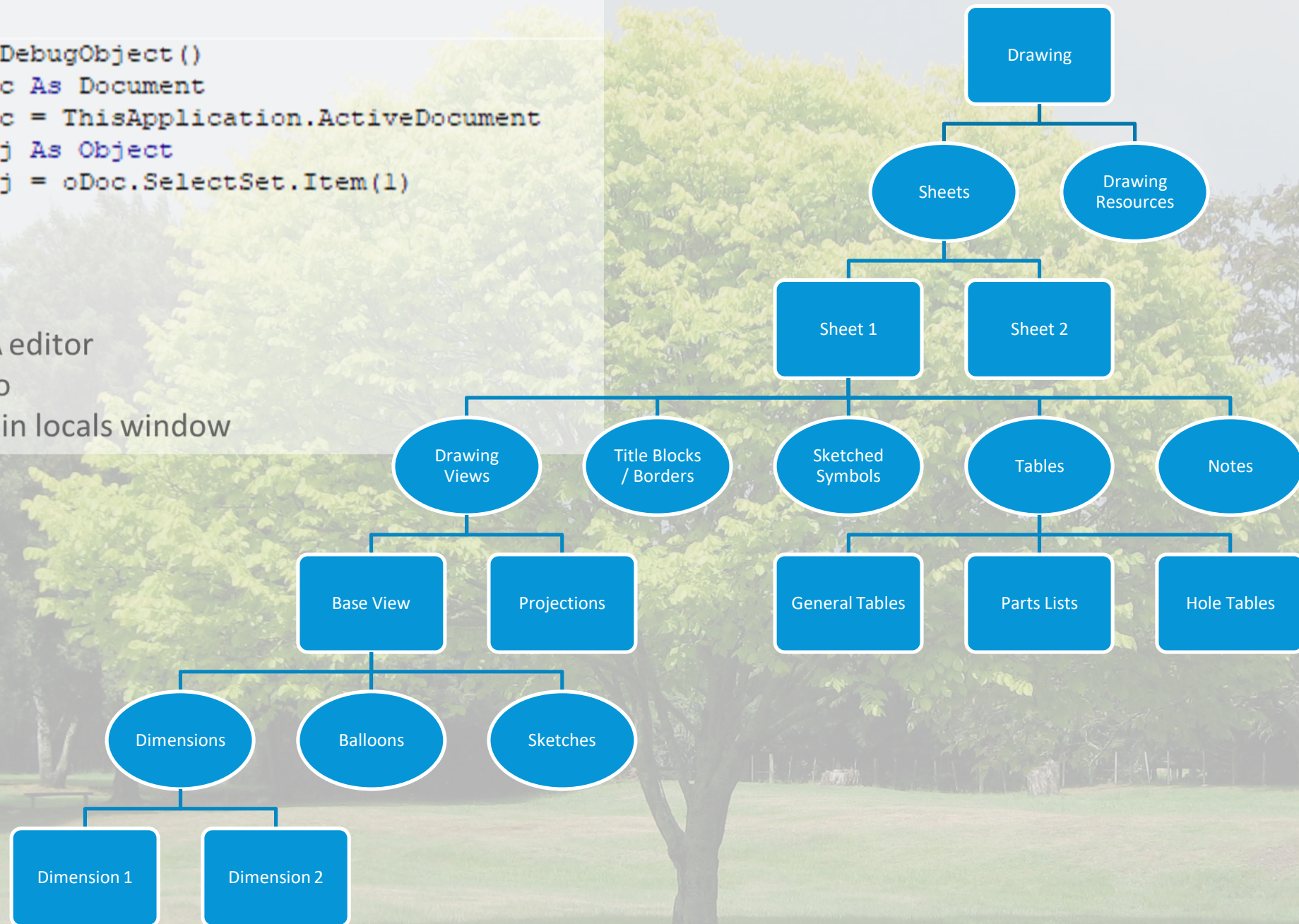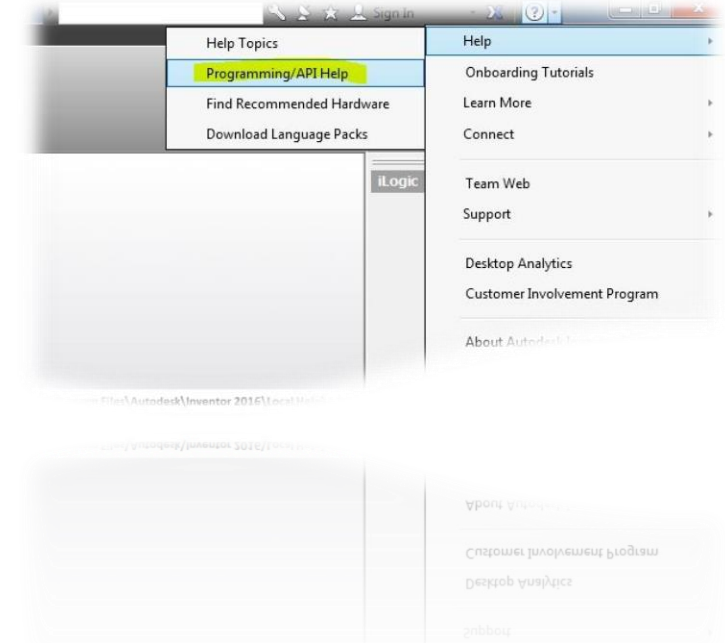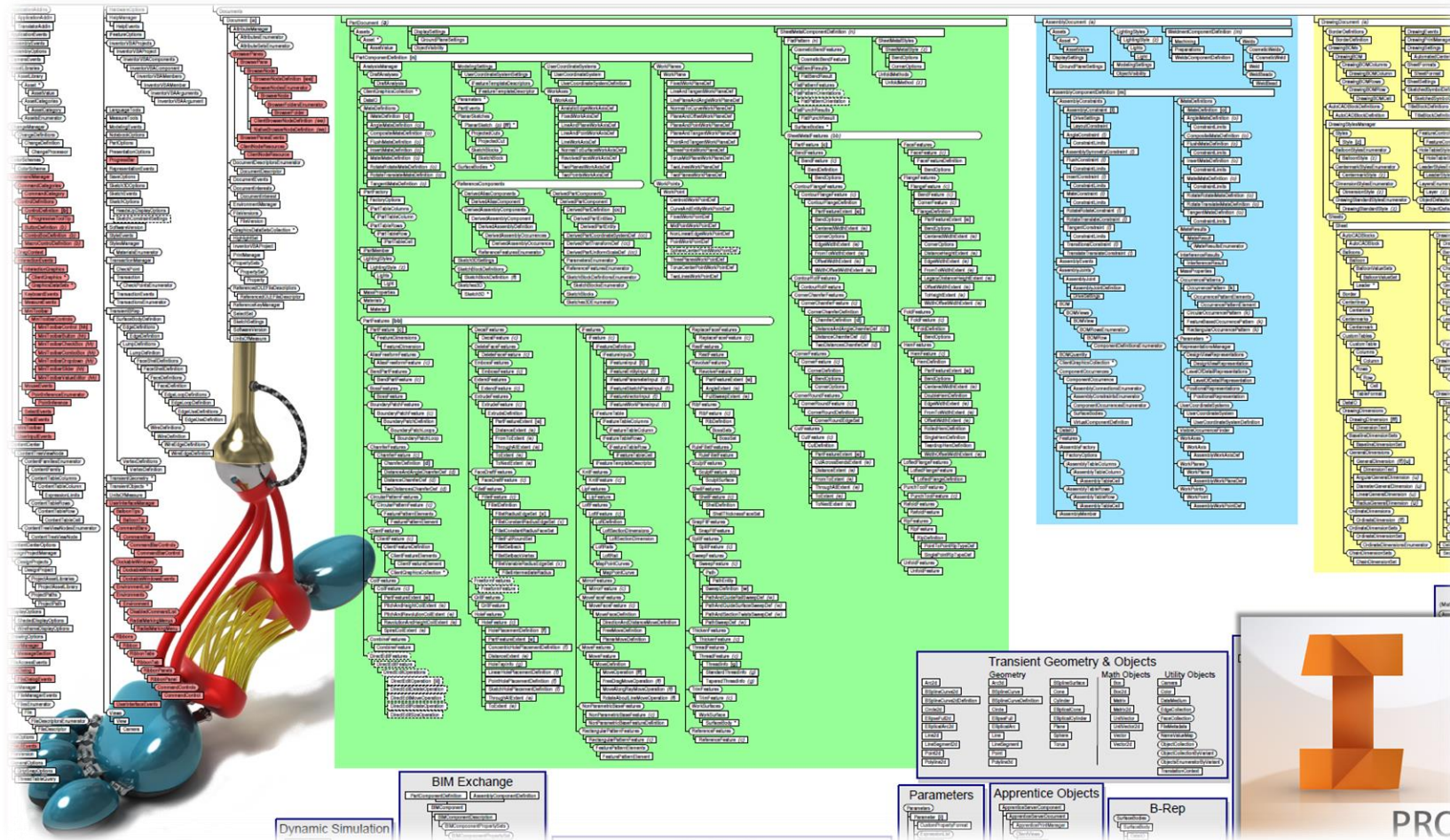
- iLogic can run VBA Macros
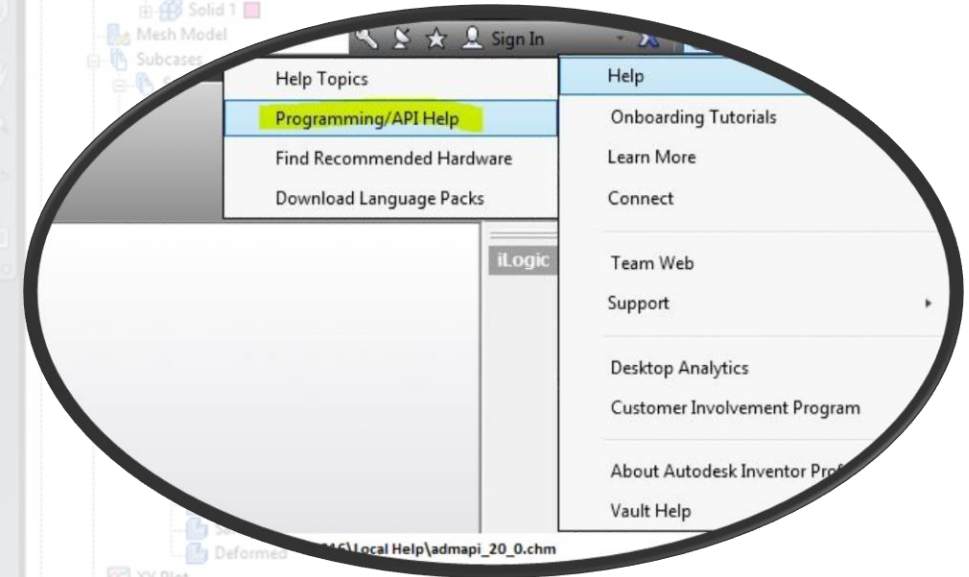
VBA helper:

```vba
Public Sub DebugObject()
    Dim oDoc As Document
    Set oDoc = ThisApplication.ActiveDocument
    Dim oObj As Object
    Set oObj = oDoc.SelectSet.Item(1)
    Stop
End Sub
```

- Select file
- Open VBA editor
- Run Macro
- View tree in locals window

Drawing

Sheets

Drawing Resources

Sheet 1

Sheet 2

Drawing Views

Title Blocks / Borders

Sketched Symbols

Tables

Notes

Base View

Projections

General Tables

Parts Lists

Hole Tables

Dimensions

Balloons

Sketches

Dimension 1

Dimension 2

API Help and Samples

Automating Nastran In-Cad

Automating the Automation?

Challenge 1: Subcases*

- Subcases used to evaluate different conditions
- Can have different Loads and Constraints

How:

Action: Create and Delete Subcase

Code: Subcases with face ID reference

Result: New subcases can be created

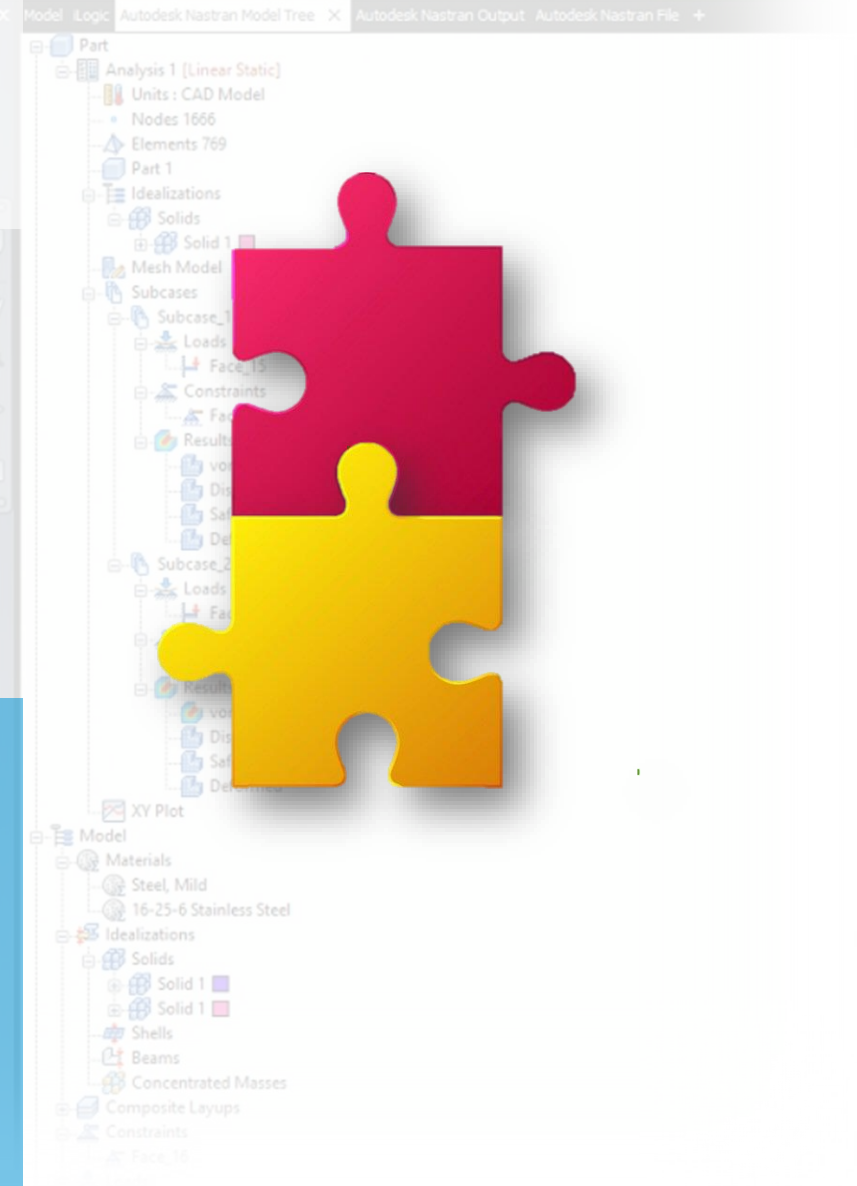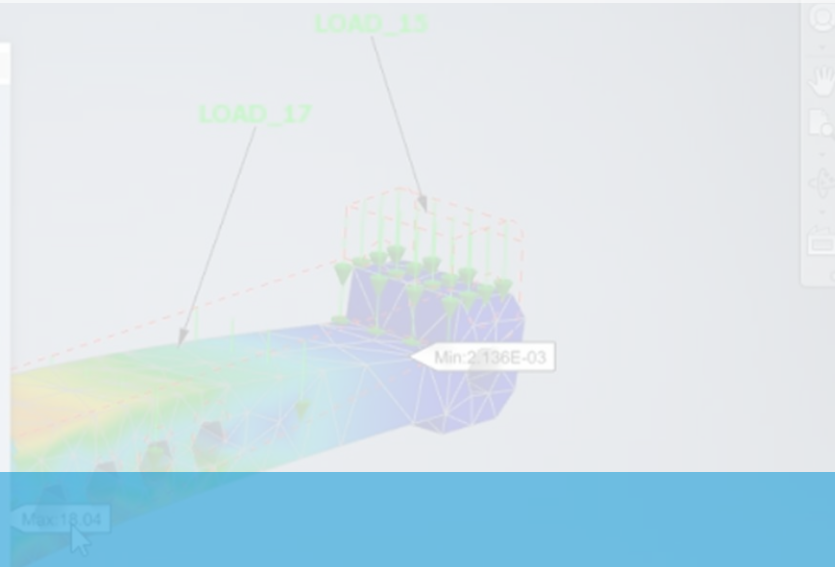*This can be the same for a new analysis
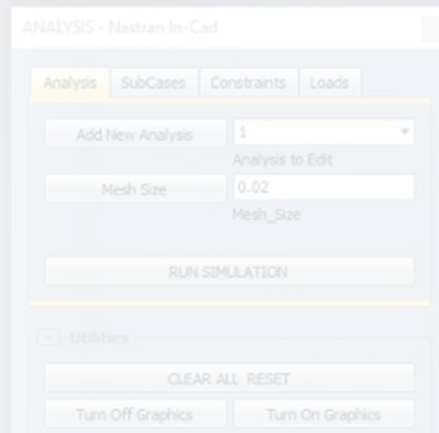
Challenge 2: Find Face ID Number

- Face ID is used to set loads and constraints
- Face ID needed in code for a set face

How:

Action: Get Face ID

Code: Rule to select and get name

Result: Reference a face name in the code
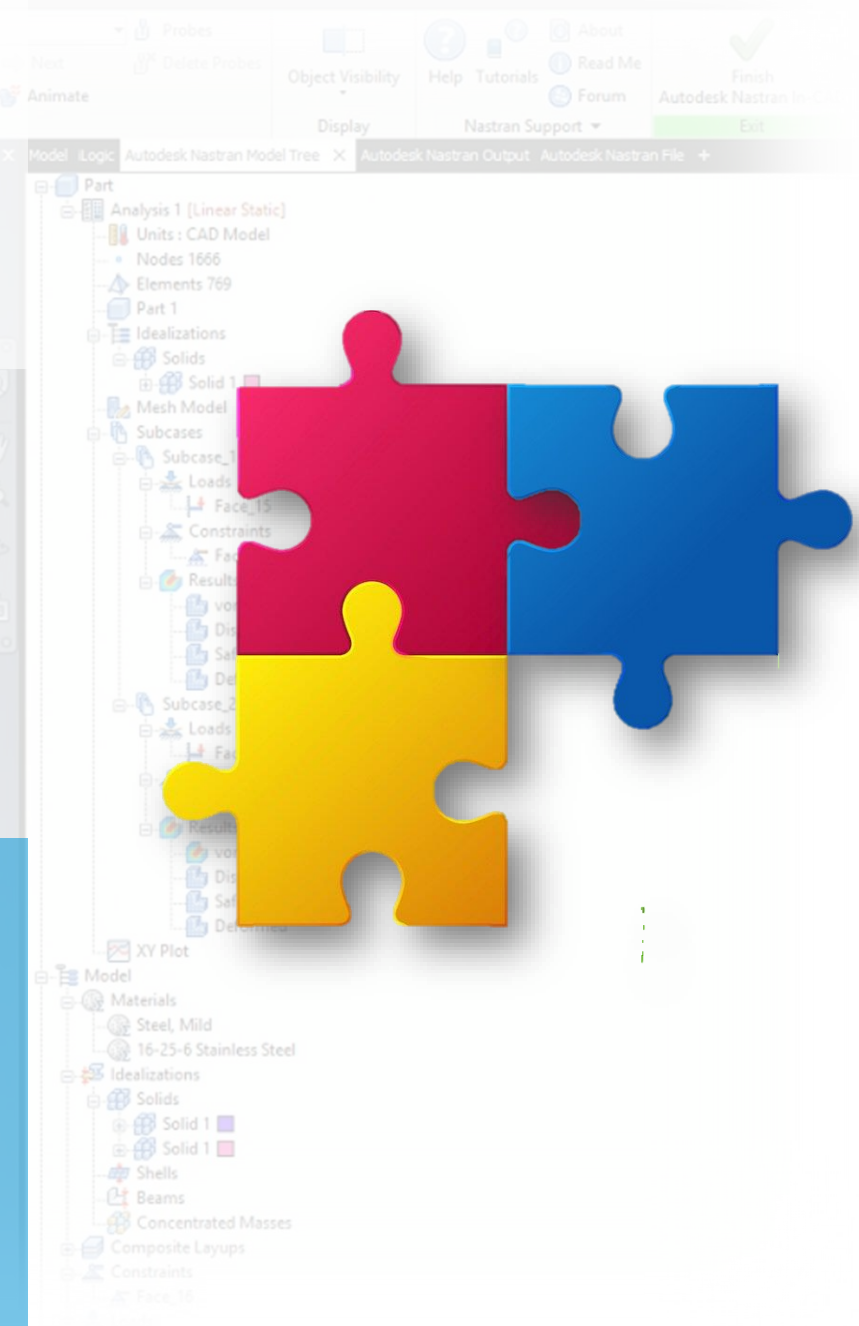
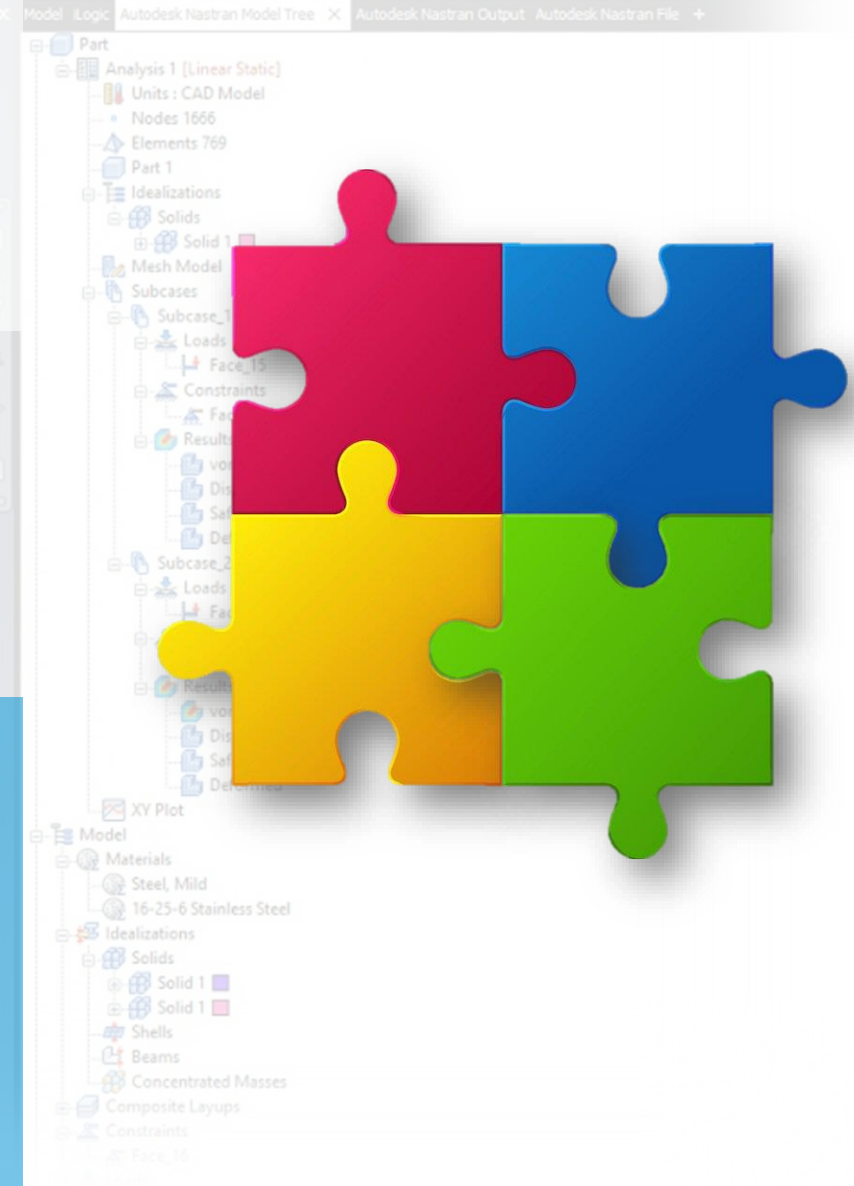# Challenge 4: Configure Loads for named Faces

- Need to dynamically set loads on faces
- Need to reference Analysis and cases

How:

Action: Generate Attribute info on faces

Code: Set and Search for a face attribute and retrieve info

Result: Face can be used in multiple cases for different subcases, Load info can be stored
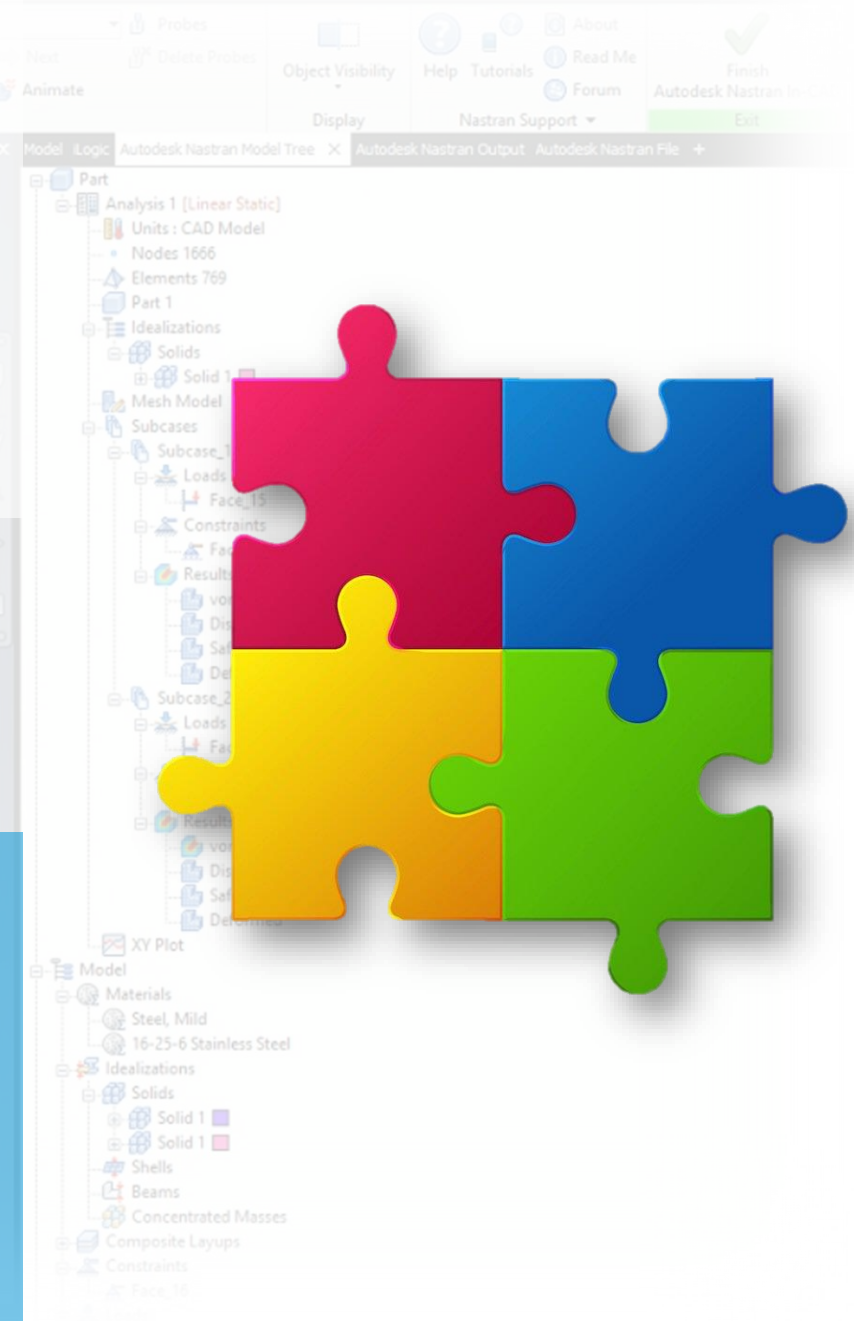
Bringing it all together

- Dynamically set up models with loads and constraints
- Add as much in as needed for a design
- Be able to evaluate results Automatically

How:
Action: Dynamic selection of Loads and Constraints
Code: Forms, Attributes, ADSK Labels
Result: A simple tool for any engineer that can be driven.

TRAINING
TEACHING KNOWLEDGE
DEVELOPMENT COACHING
LEARN NEW SKILLS

Lets Take a look ...

ANALYSIS - Nastran In-Cad

Analysis | SubCases | Constraints | Loads

Add New Analysis | 1 |
Analysis to Edit

Mesh Size | 0.02 |
Mesh_Size

RUN SIMULATION

CLEAR ALL RESET

Turn Off Graphics | Turn On Graphics

SYMETRI
ADDNODE GROUP

Done

LOAD_17

Min: 2.136E-03

Max: 18.04

Mesh Model
Subcases
Subcase_1
Loads
Face_15
Constraints
Face_16
Results
von Mises
Displacement
Safety Factor
Deformed
Subcase_2
Loads
Face_17
Constraints
Face_16
Results
von Mises
Displacement
Safety Factor
Deformed
XY Plot
Model
Materials

SYMETRI
ADDNODE GROUP

Automating Nastran In-Cad

Simulating as Part of a Process?

Vault Management

New options in 2020
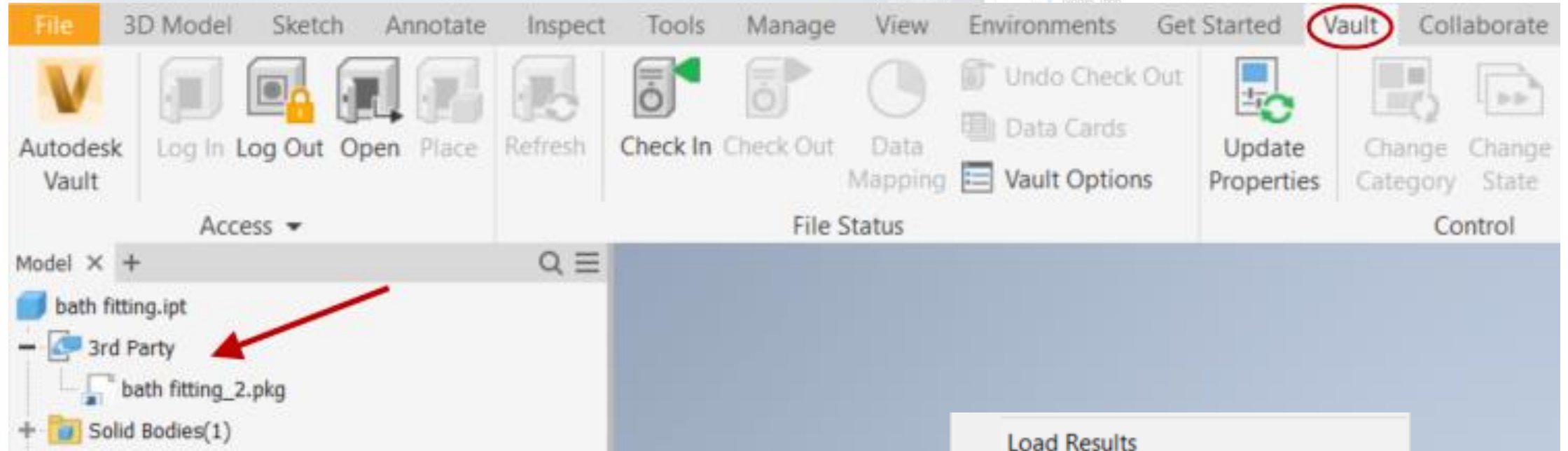
Vault Workflow Automation

Workflow Automation

When should the analysis be run?

How should results be stored?

Consistent approach?

How can the analysis be offloaded from our PCs?

May life simpler for the Checker?

Audit which documents have been analysed?

Ensure that analysis have been run?

What If We Could Automate Using Vault?

- Run analysis every time it was applicable

- Capture Results for viewing in Vault – Vault Office Users?

- Offload Analysis to the Job Processor freeing time

- Utilise Analysis as part of the sales validation process

TRAINING

TEACHING   KNOWLEDGE

DEVELOPMENT   COACHING

LEARN   NEW SKILLS

ANALYSIS - Nastran In-Cad

Analysis   SubCases   Constraints   Loads

Add New Analysis   1

Analysis to Edit

Mesh Size   0.02

Mesh_Size

RUN SIMULATION

CLEAR ALL RESET

Turn Off Graphics   Turn On Graphics

SYMETRI
ADDNODE GROUP

Lets Take a look …

LOAD_17

Min: 2.136E-03

Max: 18.04

Mesh Model
Subcases
  Subcase_1
    Loads
      Face_15
    Constraints
      Face_16
    Results
      von Mises
      Displacement
      Safety Factor
      Deformed
  Subcase_2
    Loads
      Face_17
    Constraints
      Face_16
    Results
      von Mises
      Displacement
      Safety Factor
      Deformed
XY Plot
Model
  Materials

SYMETRI
ADDNODE GROUP

Additional Resources

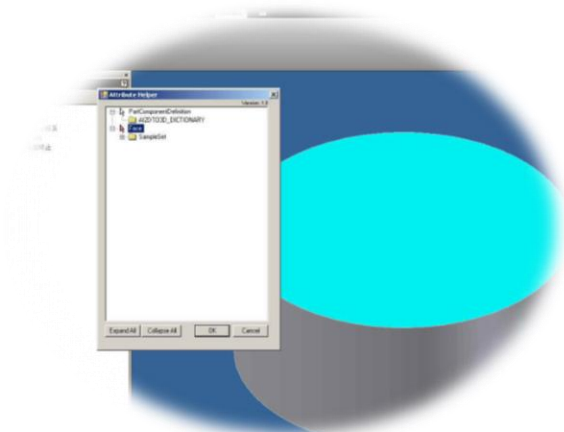**Autodesk®
Customisation
Forum**

Symetri

Blog:
Symetri Techhub

Youtube:
SymetriUk

Apps:
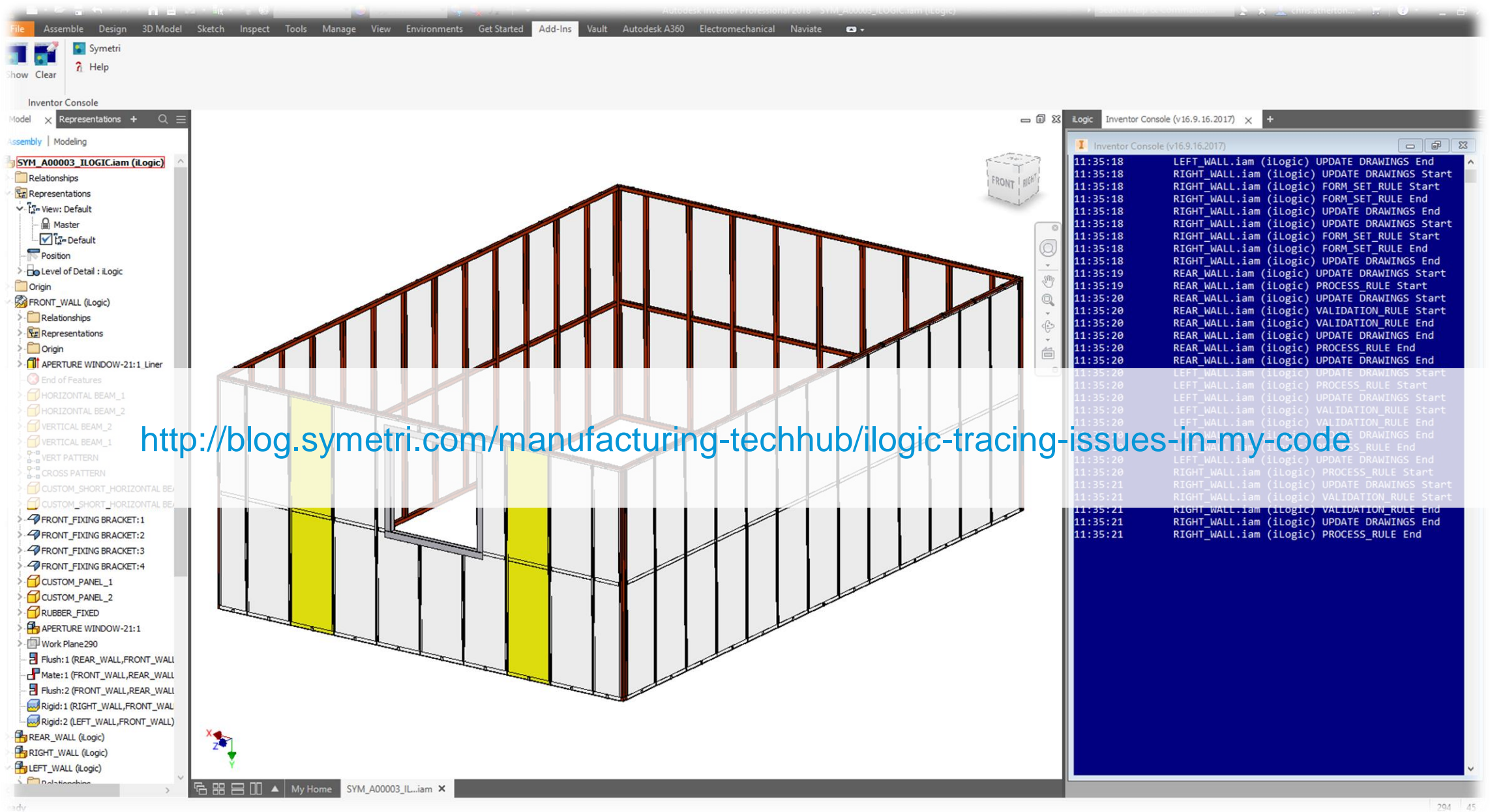iLogic Debugger Window

Resources

Eskin Solutions
Attribute Helper

Google
.net / Coding Tips

http://blog.symetri.com/manufacturing-techhub/ilogic-tracing-issues-in-my-code

Tuesday

10:45 – 11:45
Inventor road map & strategy
Loren Welch

11:50 – 12:50
Turning Days into Minutes: Forge Design Automation
Loren Welch

16:55 – 17:55
Automating Nastran In-Cad Using iLogic
Chris Atherton

Wednesday

10:45-12:15
Design Configuration with Ilogic
Lars Bjors

14:15 – 15:15
Design Automation: Revit and Inventor –Better Together
Adam Nagy

15:25 – 16:55
Up and Running with Nastran In-Cad
Wasim Younis

SYMETRI
ADDNODE GROUP

Symetri UK
+44 191 223 3400

Symetri Sweden
+46 8 704 22 00

Symetri Norway
+47 22 02 07 00

Symetri Finland
+358 (9) 5422 6500

Symetri Denmark
+45 70 10 71 10

For more information please contact Symetri:

www.symetri.co.uk

Info@symetri.co.uk

http://info.symetri.com/autodesk-university-2018

Chris Atherton

UK Consultancy Services Manager | Symetri

CHRIS.ATHERTON@SYMETRI.COM

INFO@SYMETRI.COM

SYMETRI
ADDNODE GROUP