

# MMA Fortnightly Research Seminar

## User Driven Programming

Peter Hale

# SEEDS Team Information

The Systems Engineering  
Estimation and Decision  
Support (SEEDS) team

Part of the Aerospace  
Manufacturing Research  
Centre (AMRC)

SEEDS Team Web Site

- <http://www.cems.uwe.ac.uk/amrc/seeds/>

Personal Web Site

- <http://www.cems.uwe.ac.uk/~phale/>

# User Driven Programming Approach

## Automated Generation of Modelling Programs

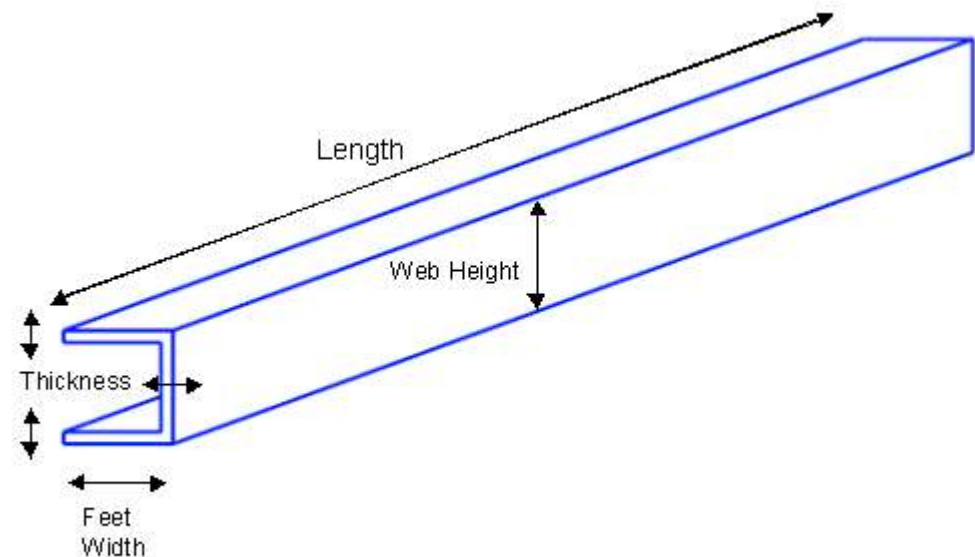
- Structure the Information Using W3C Open Standard formats - <http://www.w3.org>
- Visual creation of software by editing a tree
- Automated translation of one representation of software into many computer languages
- Allow non programmers to create and maintain software visually

# Early Approach

Illustrated with Spar  
Example

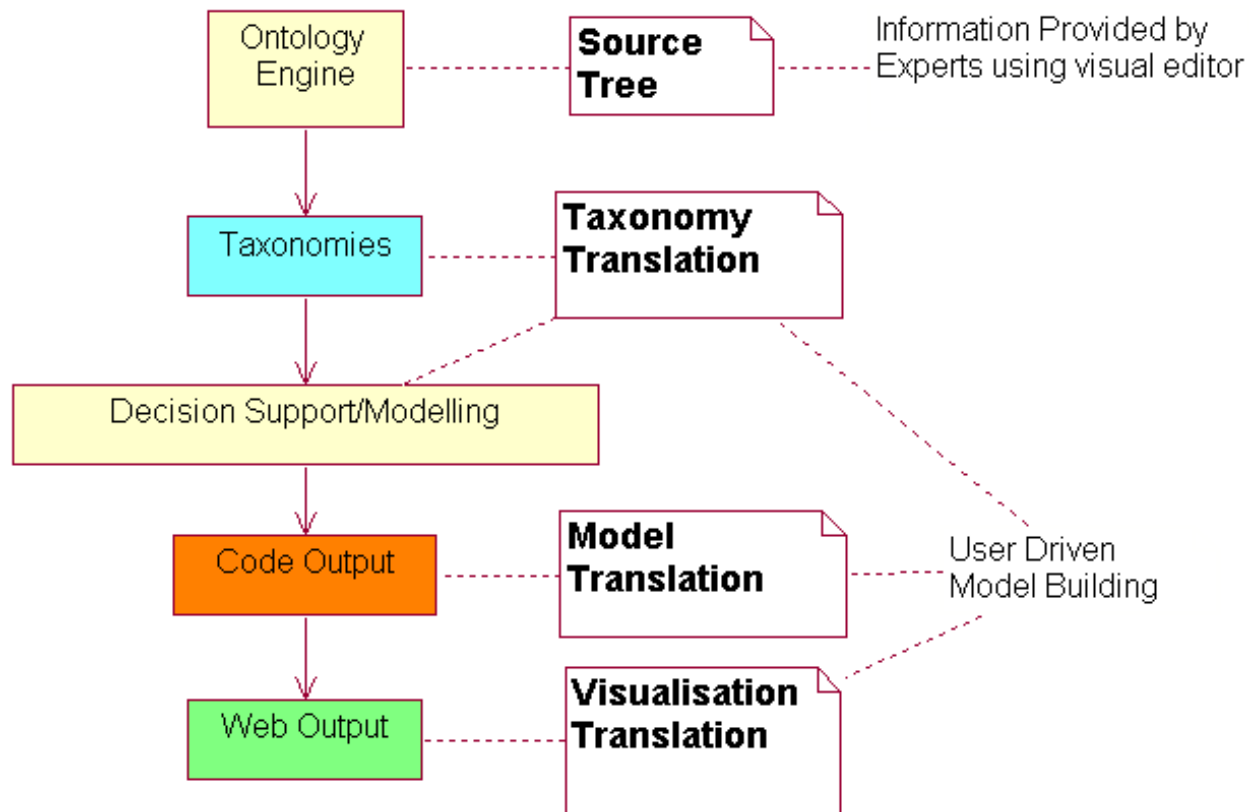
- Created example system based on aircraft spar

- Costed Hand Lay Up manufacturing process



# Automated Generation of Modelling Programs

## Translation Process



# Translation

- An Ontology defines relationships between things
- Relationships can be conveyed to a software model that evaluates them

To achieve this the translator requires -

- 1 Search trigger(s) resulting from user actions
- 2 Knowledge of the relationships between nodes in the tree
- 3 Ability to read a equations held in a standardised mathematical form
- 4 Rules of syntax for the language of the code to be output

# Ontology Editing and Translation

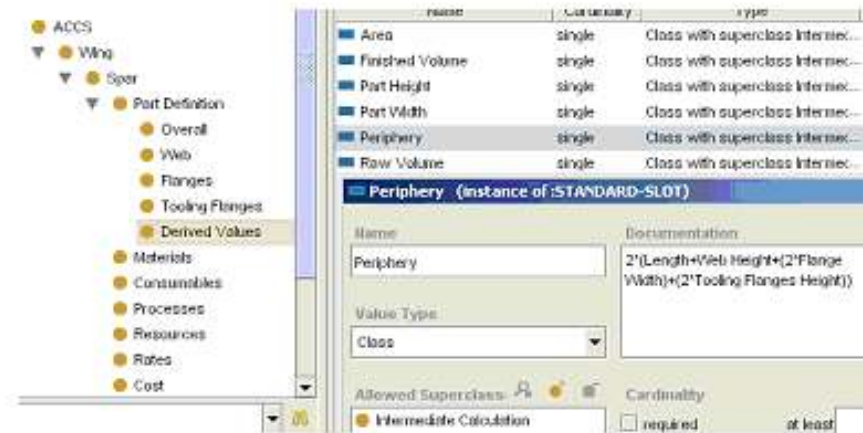
Stanford University

<http://protege.stanford.edu/>

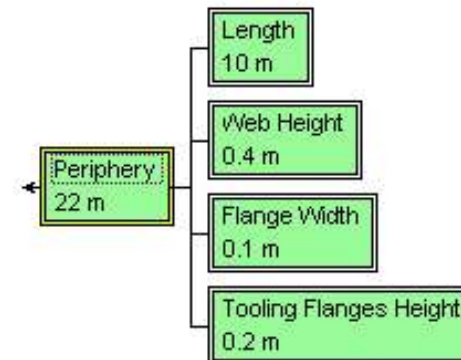


DecisionPro (Now called Vanguard Studio)

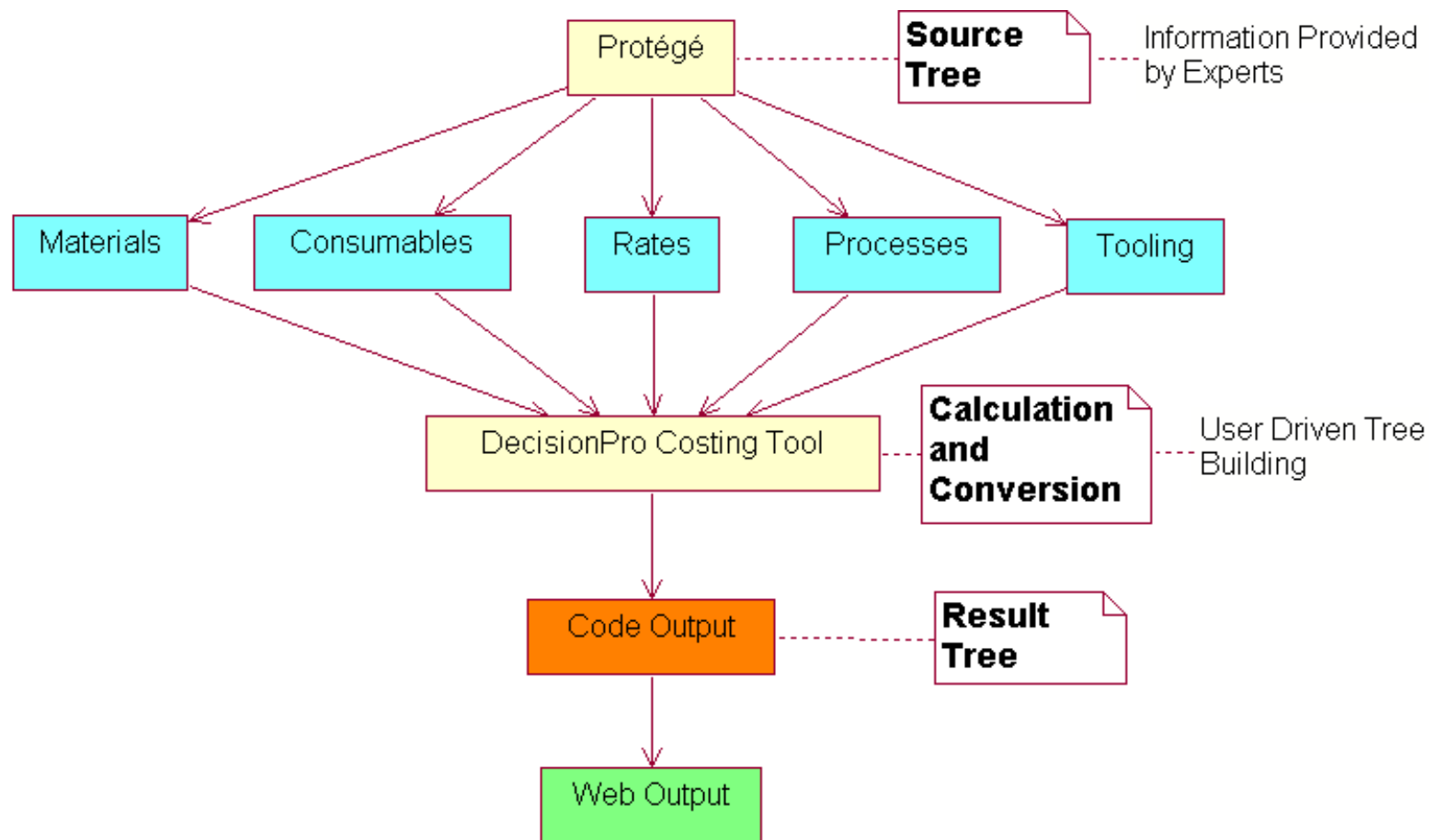
<http://www.vanguardsw.com/decisionpro/>



Periphery:=2\*(Length+Web Height+(2\*Flange Width)+(2\*Tooling Flanges Height))

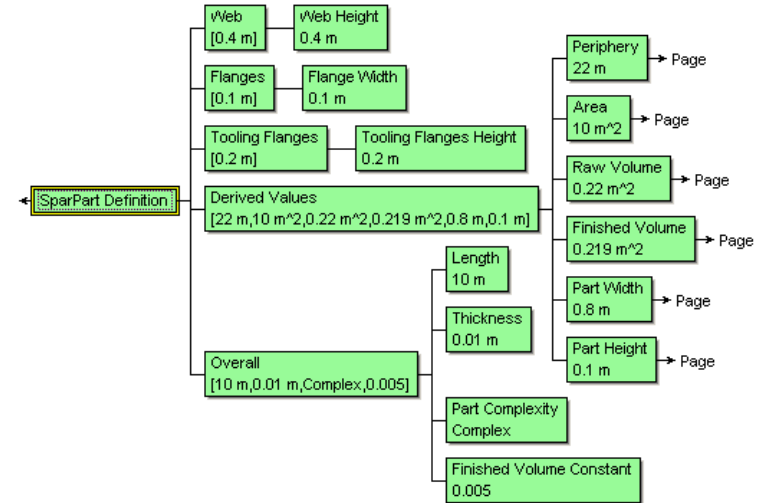
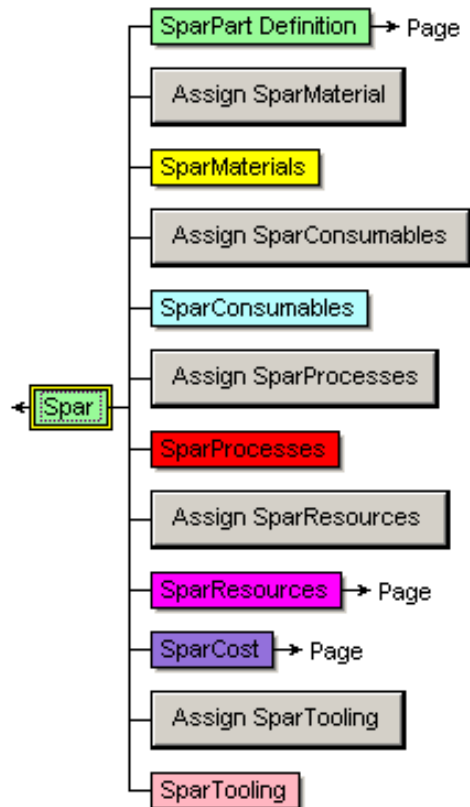


# Translation Implementation



# Translation Tree

Automated Recursive Queries create large colour coded result tree



# Translation Example

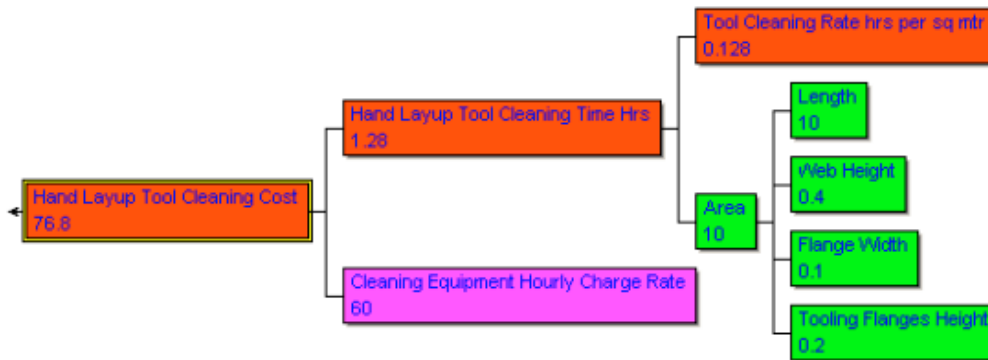
- Equations Define Relationships
- Relationships Visualised
- Equations Translated to program code

DecisionPro  
(Vanguard  
Studio)



Web and other  
computer  
languages

Hand Layup Tool Cleaning Cost=Hand Layup Tool Cleaning Time Hrs\*Cleaning Equipment Hourly Charge Rate



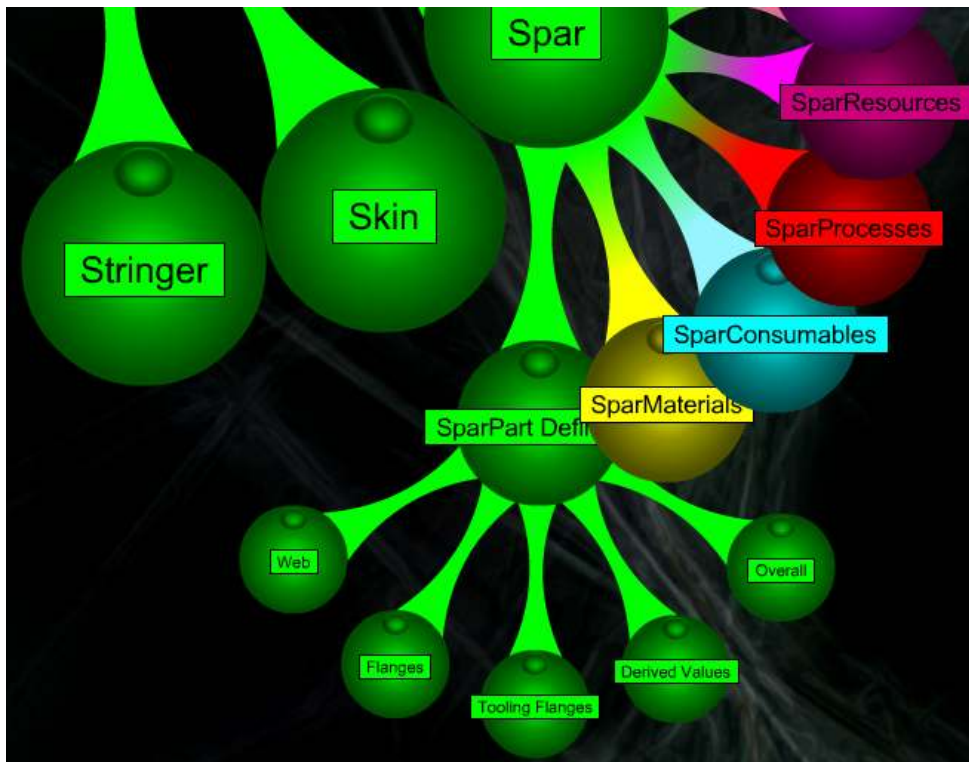


# Web Output Visualisation 2

## XML and Flash

Rhodes et al.

<http://www.friendsofed.com/books/1590591585/>



# Interactive Visualisation

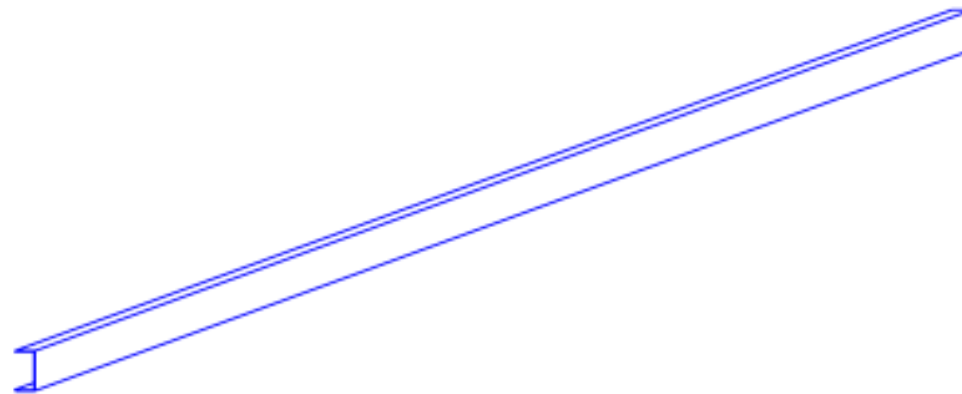
SVG (Scalable Vector Graphics)

<http://www.cems.uwe.ac.uk/~phal e/InteractiveSVGExamples.htm>

Tree Based Representation



Interactive Diagram



Scale 1m =

Automatically recalculates shape and equations

WebHeight ( m )	<input type="text" value="0.4"/>	Periphery ( m )	<input type="text" value="22"/>	$Periphery=2*(Length+WebHeight+(2*FlangeWidth)+(2*ToolingFlangesHeight))$	<input type="button" value="Zoom In"/> <input type="button" value="Zoom Out"/> <input type="button" value="Up"/> <input type="button" value="Down"/> <input type="button" value="Left"/> <input type="button" value="Right"/>
FlangeWidth ( m )	<input type="text" value="0.1"/>	Area ( m <sup>2</sup> )	<input type="text" value="10"/>	$Area=Length*(WebHeight+2*(FlangeWidth+ToolingFlangesHeight))$	
ToolingFlangesHeight ( m )	<input type="text" value="0.2"/>	RawVolume ( m <sup>3</sup> )	<input type="text" value="0.22"/>	$RawVolume=Periphery*Thickness$	
Length ( m )	<input type="text" value="10"/>	FinishedVolume ( m <sup>3</sup> )	<input type="text" value="0.219"/>	$FinishedVolume=RawVolume-(2*Length*Thickness*FinishedVolumeConstant)$	
Thickness ( m )	<input type="text" value="0.01"/>	PartWidth ( m )	<input type="text" value="0.8"/>	$PartWidth=WebHeight+(2*ToolingFlangesHeight)$	
PartComplexity	<input type="text" value="Complex"/>	PartHeight ( m )	<input type="text" value="0.1"/>	$PartHeight=FlangeWidth$	
FinishedVolumeConstant	<input type="text" value="0.005"/>				



# Conclusions

- User Driven Modelling approach involves emphasis on visualisation, interoperability, and user feedback
- Tools are needed to allow people to model problems at a high level of abstraction rather than to get bogged down in code.
- Further Research into Web Based Simulation would be useful