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XML/STEP/OMG Technologies to Facilitate Generic Coupling of Different Analysis Codes

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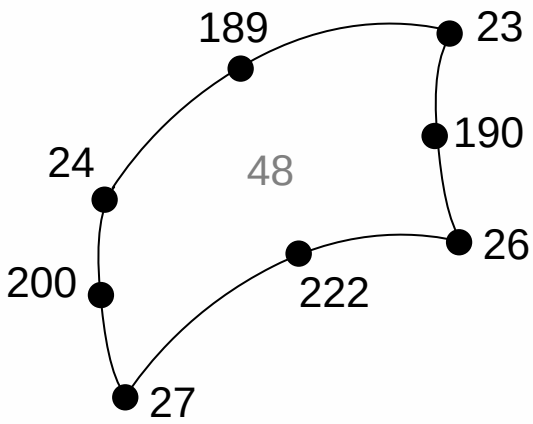
Element Based Analyses

- 100's commercial codes available (FEA, FV, BEM, DEM)
- STEP AP209 specification – carefully planned
    - Describes structures, fields, changes of state
    - PDM enabled and feedback to design compliant
- XML - Method of Storing OO data
- Lightweight Specification for interoperable EA enterprise applications
- May be combined with an OMG equivalent specification for CAE services

XML & EA Standard




```
<Node ID="23">
        <Coord>0.2500  0.7500  0.8750</Coord>
</Node>
<Element ID="48"  ElementType="#QU8PS"  Material="http://somewhere.org/MatDB#xyz_123">
    <ChordNodes>23  26  27  24</ChordNodes>
    <MidNodes>190  222  200  189</MidNodes>
</Element>
```

Element Based Analyses

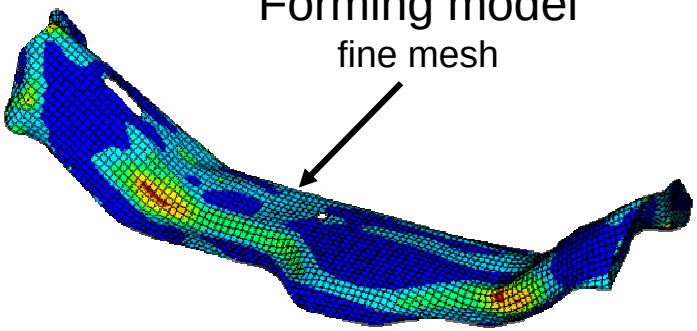
Use of XML:

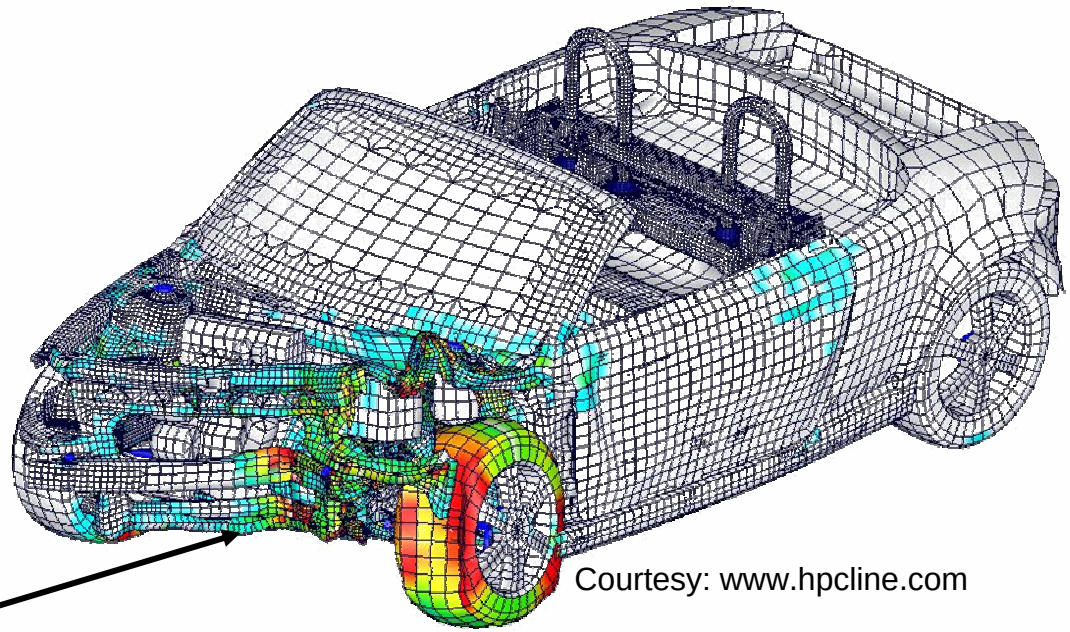
- Document type definition (DTD) or schema
  - can be based on AP 209
- Open source tools (freely available on web)
  - XSLT/Xalan - supports mapping to native formats
- MathML – analytic description of boundary conditions
- Hierarchical Data Format 5 (NCSA)
  - combined use with XML
  - large results files no problem
- Resource Description Framework - lightweight ontology
  - supporting the exchange of knowledge on the Web
  - dictionaries of materials information and behaviour types

Transfer of Results

Stresses/Strains
Mapping methods
Kinematically equivalent distributions

Forming model
fine mesh

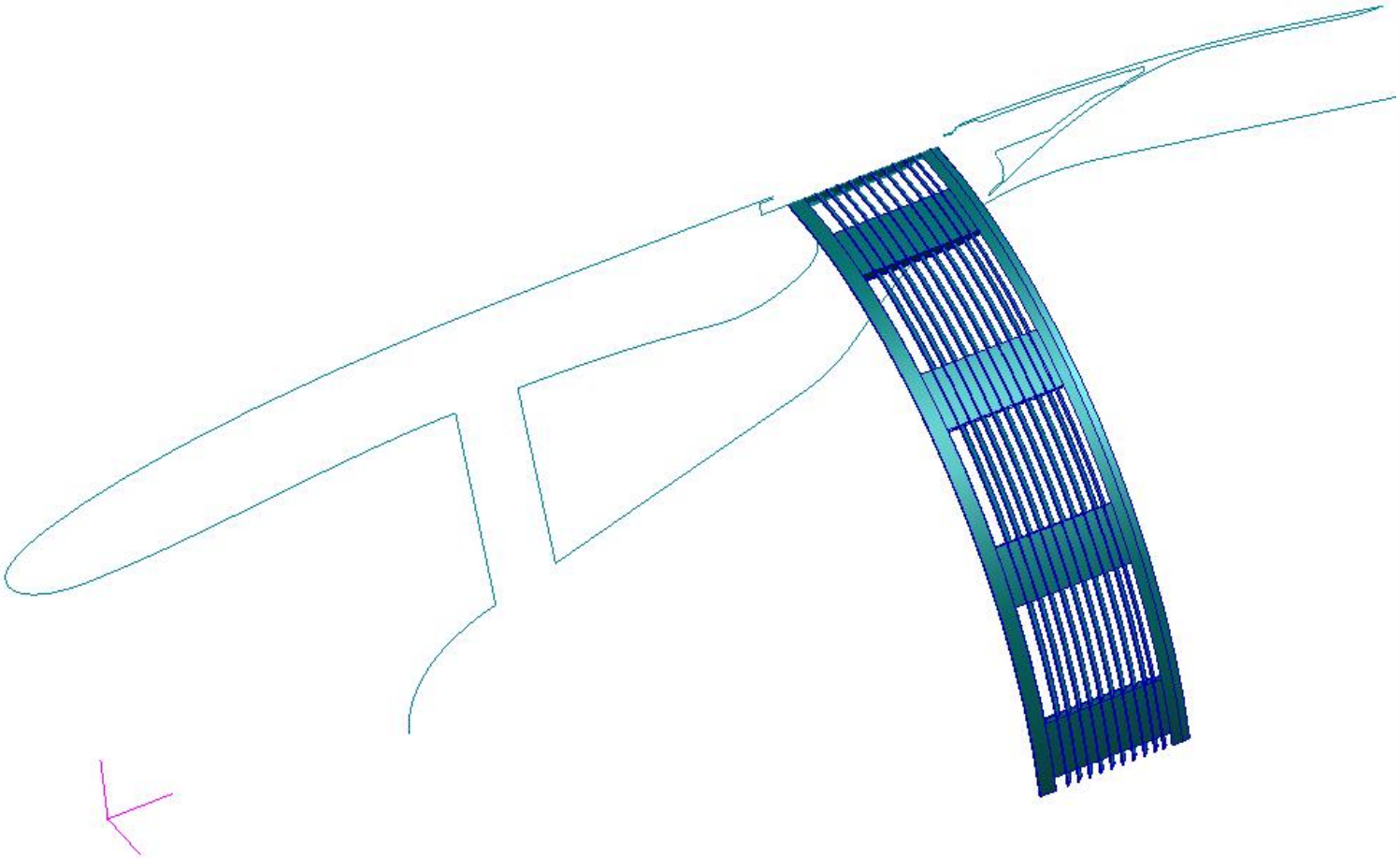




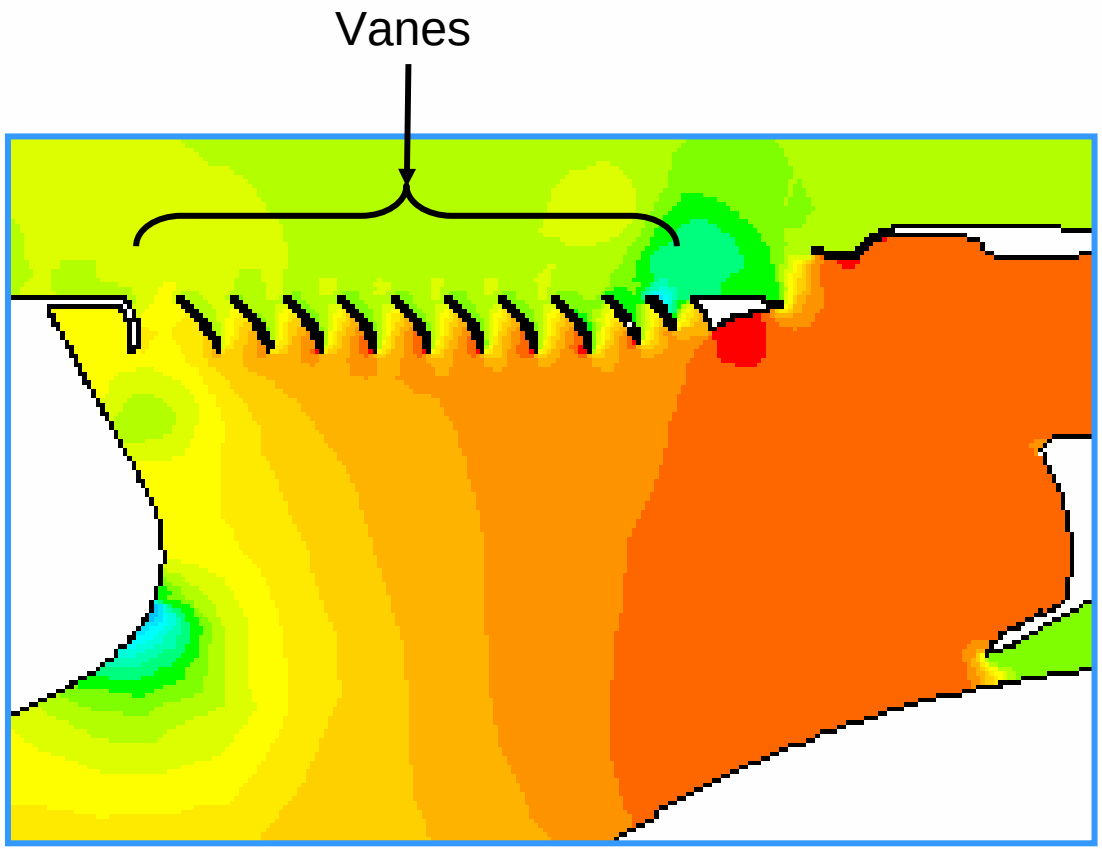
Crash model
coarse mesh

Courtesy: www.hpcline.com

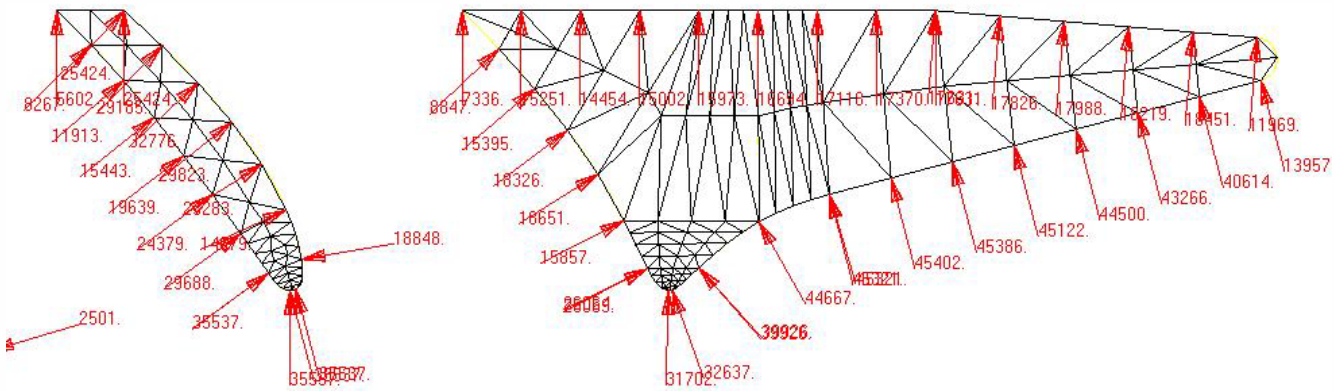
Fluid/Structural Case Study



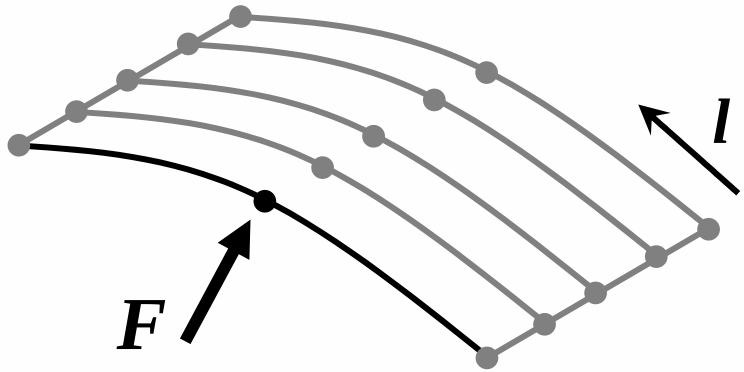
Fluid/Structural Case Study



Fluid/Structural Case Study



$$F/l = \oint_s P\,ds$$



The Future

Long term storage:

- STEP AP209 specification for archiving and PDM

Light weight data sharing:

- XML – ideal transport for data sharing
- XSLT – provides means to transform to and from proprietary formats
- URI – external references to material and element libraries

Close coupled analyses:

- Integrated scripting for control of multi-physics analyses
- OMG compatible CAE scripting environment
- Full Interoperability between EA based enterprise solutions
- Extensible to large analyses

Common repertoire of engineering concepts - all approaches platform independent