- **Language**: MATLAB (Matrix Laboratory)
  - *Interpreted, object-oriented, with weakly dynamic* type system
  - Wealth of high-level functions and *toolboxes*
  - Used for rapid prototyping, data postprocessing, visualization, and teaching in numerical and engineering applications

- **Transformation**: ADiMat (Automatic Differentiation for Matlab)
  - Source-2-source code transformation tool for Matlab
  - Goal: Compute derivatives of Matlab functions

- **Implementation**
  - Bison/Flex parser for Matlab creates AST in form of XML document
  - Syntax tree is transformed and unparsed with XSLT

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**Example**: [http://www.it.uu.se/grad/courses/optforDE/](http://www.it.uu.se/grad/courses/optforDE/)

- 1D Finite Element simulation of a uniformly loaded simply supported beam
- Optimize shape \( \phi \) for stiffness under weight constraint
- Cost function \( J(\phi) \), implemented in function \( \text{fun} \)
- Derivative \( \frac{dJ}{d\phi} \):
  \[
  \text{admDiff(@fun, 1, phi)}
  \]