SymPy — a library for symbolic mathematics in pure Python

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November 4, 2009
SymPy

- A pure Python library for symbolic mathematics

```python
>>> from sympy import *
>>> x = Symbol('x')

>>> limit(sin(pi*x)/x, x, 0)
pi

>>> integrate(x + sinh(x), x)
(1/2)*x**2 + cosh(x)

>>> diff(_, x)
x + sinh(x)
```
Capabilities
What SymPy can do

• core functionality
  ◦ differentiation, truncated series
  ◦ pattern matching, substitutions
  ◦ non–commutative algebras
  ◦ assumptions engine, logic
• symbolic ...
  ◦ integration, summation
  ◦ limits
• polynomial algebra
  ◦ Gröbner bases computation
  ◦ multivariate factorization
• matrix algebra

• equations solvers
  ◦ algebraic, transcendental
  ◦ recurrence, differential
• systems solvers
  ◦ linear, polynomial
• pretty–printing
  ◦ Unicode, ASCII
  ◦ LaTeX, MathML
• 2D & 3D plotting
• ...

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Miscellaneous

• advantages of pure python
  ○ jython (sympy can be used in java applications)
  ○ useful for testing python implementations: 1565 tests in 139 files on 21584 lines (pypy, jython, unladen swallow)
  ○ google app engine
  ○ iphone
  ○ easy to deploy on windows

• easy to use in web applications
  ○ google app engine
  ○ http://live.sympy.org/
  ○ http://gamma.sympy.org/

• finite element solvers
  ○ defining equations for finite element (and other) solvers
  ○ generating (C/C++) shape functions (Legendre, Lobatto, ...)
  ○ ...

• other usages
  ○ calculate things symbolically, in conjunction with numerics (numpy, scipy)
  ○ physics (quantum mechanics, general relativity, ...)
  ○ teaching (calculus, numerics, ...)
  ○ ...