

MATLAB Automatic Differentiation (MAD) is a professionally maintained and developed automatic differentiation tool for MATLAB. Many new features are added continuously since the development and additions are made in close cooperation with the user base.

Automatic differentiation is generally defined as (after Andreas Griewank, Evaluating Derivatives - Principles and Techniques of Algorithmic Differentiation, SIAM 2000):

"Algorithmic, or automatic, differentiation (AD) is concerned with the accurate and efficient evaluation of derivatives for functions defined by computer programs. No truncation errors are incurred, and the resulting numerical derivative values can be used for all scientific computations that are based on linear, quadratic, or even higher order approximations to nonlinear scalar or vector functions."

MAD is a MATLAB library of functions and utilities for the automatic differentiation of MATLAB functions and statements. MAD utilizes an optimized class library "derivvec", for the linear combination of derivative vectors.



Key Features

- A variety of trigonometric functions.
- FFT functions available (FFT, IFFT).
- interp1 and interp2 optimized for differentiation.
- Delivers floating point precision derivatives (better robustness).
- A new MATLAB class ***fmad*** which overloads the builtin MATLAB arithmetic and some intrinsic functions. More than 100 built-in MATLAB operators have been implemented.
- The classes allow for the use of MATLAB's sparse matrix representation to exploit sparsity in the derivative calculation at runtime.
- Normally faster or equally fast as numerical differentiation.
- Complete integration with all TOMLAB solvers.
- Possible to use as plug-in for modeling class tomSym and optimal control package PROPT.

MAD Example

```
>> x = fmad(3,1);  
>> y = x^2 + x^3;  
>> getderivs(y)  
  
ans = 33
```

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