

# NEWS for pracma version 0.6-0

June 24, 2011

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NEWS

*pracma News*

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## **Changes in Version 0.6-1 (2011-06-25)**

- Changed `gauss_kronrod()` and `clenshaw_curtis()` to become adaptive integration routines.

## **Changes in Version 0.6-0 (2011-06-24)**

- `muller()` Muller's root finding method.
- Added differential equation example to `expm()`'s help page.
- Changed NEWS file to become simpler (no subsections); updated the NEWS.Rd, NEWS.pdf files.

## **Changes in Version 0.5-9 (2011-06-23)**

- `quadl()` recursive adaptive Gauss-Lobatto quadrature.
- `simpadpt()` another recursively adaptive Simpson's rule.
- Added testing procedures for all integration routines; corrected, refined some of these procedures.

## **Changes in Version 0.5-8 (2011-06-20)**

- `quadgr()` Gaussian Quadrature with Richardson extrapolation, can handle singularities at endpoints and (half-)infinite intervals.

## **Changes in Version 0.5-7 (2011-06-18)**

- `expm()` for matrix exponentials.
- `clenshaw_curtis()` the Clenshaw-Curtis quadrature formula.

**Changes in Version 0.5-6 (2011-06-17)**

- `simpson2d()` as non-adaptive 2-dimensional Simpson integration.
- `dblquad()` twofold application of internal function `integrate()`.

**Changes in Version 0.5-5 (2011-06-15)**

- `gaussHermite()` and `gaussLaguerre()` for infinite intervals.
- Fresnel integrals `fresnelS()` and `fresnelC()`.

**Changes in Version 0.5-4 (2011-06-12)**

- `gaussLegendre()` computes coefficients for Gauss Quadrature, and `quad2d()` uses these weights for 2-dimensional integration.
- `quadinf()` wrapper for `integrate()` on infinite intervals.
- Added a version for rapid pi computation to the `agm()` examples.

**Changes in Version 0.5-3 (2011-06-06)**

- `ode23()` solving first order (systems of) differential equations.
- `barylag2d()` 2-dimensional barycentric Lagrange interpolation.

**Changes in Version 0.5-2 (2011-06-04)**

- `interp2()` for two-dimensional interpolation.
- `gradient()` now works in two dimensions too.

**Changes in Version 0.5-1 (2011-06-01)**

- `fzero()`, `fminbnd()`, `fminsearch()`, `fsolve()` as aliases for `uniroot()`, `optimize()`, `optim()` with Nelder-Mead, `newtonsys()`.

**Changes in Version 0.5-0 (2011-05-31)**

- Corrections to help pages.

**Changes in Version 0.4-9 (2011-05-30)**

- `romberg()` and `gauss_kronrod()` for numerical integration.
- Richardson's extrapolation in `numderiv()`, `numdiff()`.
- Discrete numerical derivatives (one dimension): `gradient()`.

**Changes in Version 0.4-8 (2011-05-28)**

- Numerical function derivatives: `fderiv()`, `grad()`.
- Specialized operators: `hessian()`, `laplacian()`.
- Application: `taylor()`.

**Changes in Version 0.4-7 (2011-05-27)**

- plot vector fields: `quiver()` and `vectorfield()`.
- `findintervals()`.
- Corrections in `deval()`, `deeve()`, using `findintervals()`.

**Changes in Version 0.4-6 (2011-05-26)**

- Laguerre's method `laguerre()`.
- `rk4()` and `rk4sys()` classical fourth order Runge-Kutta.
- `deval()`, `deeve()` evaluate ODE solutions.

**Changes in Version 0.4-5 (2011-05-24)**

- Lebesgue coefficient: `lebesgue()`.
- `poly2str()` for string representation of a polynomial.

**Changes in Version 0.4-4 (2011-05-23)**

- Dirichlet's `eta()` and Riemann's `zeta()` function.
- `rmserr()` different accuracy measures; `std_err()` standard error.

**Changes in Version 0.4-3 (2011-05-22)**

- `polypow()` and `polytrans()` for polynomials.
- `polyApprox()` polynomial approximation using Chebyshev.
- `trigPoly()`, `trigApprox()` for trigonometric regression.

**Changes in Version 0.4-2 (2011-05-17)**

- `segm_intersect()` and `segm_distance()` segment distances.
- `inpolygon()`.

**Changes in Version 0.4-1 (2011-05-13)**

- `polyadd()` polynomial addition.
- `conv()` and `deconv()` time series (de)convolution.
- `detrend()` removes (piecewise) linear trends.
- `ifft()` for normalized inverse Fast Fourier Transform.

**Changes in Version 0.4-0 (2011-05-10)**

- Added tests for functions since version 0.3-7.

**Changes in Version 0.3-9 (2011-05-09)**

- `and()` and `or()`.

**Changes in Version 0.3-8 (2011-05-06)**

- `pchip()` and option 'cubic' for `interp1()` interpolation.
- The complex gamma functions `gammaz()`.
- `hadamard()` and `toeplitz()` matrices.

**Changes in Version 0.3-7 (2011-05-04)**

- Rank of a matrix, `mrank()`, and `nullspace()` for the kernel.
- `orth()`, orthogonal basis of the image space, and `subspace()` determines the angle between two subspaces.
- `normest()` for estimating the (Frobenius) norm of a matrix, and `cond()` determines the condition number of a matrix.

**Changes in Version 0.3-6 (2011-04-30)**

- `fact()`, more accurate than the R internal function 'factorial'.
- `ezplot()` as an alias for `curve()`, but with option "fill = TRUE".
- `aitken()` for accelerating iterations.
- Renamed `polycnv()` to `polymul()`.
- Renamed `outlierMAD()` to `hampel()`.

**Changes in Version 0.3-5 (2011-04-23)**

- `agm()` for the arithmetic-geometric mean.
- Lambert W function `lambertWp()` for the real principal branch.
- "Complex Step" derivation with `complexstep()` and `jacobiancsd()`.

**Changes in Version 0.3-4 (2011-04-21)**

- Barycentric Lagrange interpolation through `barylag()`.
- `polyfit2()` fits a polynomial that exactly meets one additional point.
- Added more references to the help entry 'pracma-package.Rd'.

**Changes in Version 0.3-3 (2011-04-19)**

- `hornerdefl()` for also returning the deflated polynomial.
- `newtonHorner()` combining Newton's method and the Horner scheme for root finding for polynomials.
- `jacobian()` computes the Jacobian of a function  $R^n \rightarrow R^m$  as simple numerical derivative.
- `newtonsys()` applies Newton's method to functions  $R^n \rightarrow R^n$  with special application to root finding of complex functions.
- `newton()` renamed to `newtonRaphson()`.

**Changes in Version 0.3-2 (2011-04-17)**

- Sorting functions: bubbleSort(), insertionSort(), selectionSort(), shellSort(), heapSort(), mergeSort(), mergeOrdered(), quickSort(), quickSortx(), is.sorted(), and testSort().
- Functions from number theory: eulersPhi(), moebiusFun() and the mertensFun(), sigma(), tau(), omega(), and Omega().

**Changes in Version 0.3-1 (2011-04-16)**

- Chebyshev polynomials of the first kind: chebPoly(), chebCoeff(), and chebApprox().

**Changes in Version 0.3-0 (2011-04-09)**

- New version of news.Rd, news.pdf.
- More test functions for root finding and quadrature.

**Changes in Version 0.2-9**

- fnorm() and the Runge function runge().
- contfrac(), rat(), and rats() for continuous fractions.
- meshgrid() and magic().

**Changes in Version 0.2-8**

- quad() adaptive Simpson quadrature.
- Minimum finding with fibsearch() and golden\_ratio().
- Root finding with newton(), secant(), and brentDekker().

**Changes in Version 0.2-7**

- Regular expression functions regexp(), regexp(), regprep() and refindall().

**Changes in Version 0.2-6**

- String functions blanks(), strtrim(), deblank(), strjust(), and strrep().
- interp1() one-dimensional interpolation (incl. spline)

**Changes in Version 0.2-5**

- Matlab functions mode(), clear() and beep().

**Changes in Version 0.2-4**

- primroot() finds the smallest primitive root modulo a given n; needed functions are modpower() and modorder().
- humps() and sinc(): Matlab test functions.
- Root finding through bisection: bisect(), regulaFalsi().
- outlierMAD(), findpeaks(), and piecewise().

- `polycnv()` for polynomial multiplication.
- Functions `extgcd()`, `gcd()`, and `lcm()` have been renamed to `extGCD()`, `GCD()`, and `LCM()` respectively.

### Changes in Version 0.2-3

- `strfind()`, `strfindi()`, and `findstr()`.
- `circlefit()` fitting a circle to plane points.
- `mldivide()` and `mrdivide()`, emulating the Matlab backslash operator.

### Changes in Version 0.2-2

- `vnorm()` vector norm
- Warning about a nasty “non-ASCII input” in the `savgol.RD` file has been resolved.

### Changes in Version 0.2-1

- `horner()` implementing the horner scheme for evaluating a polynomial and its derivative.
- `savgol()` Savitzki-Golay smoothing and needed pseudoinverse `pinv()`.

### Restarted as Version 0.2-0

- Package renamed to ‘`pracma`’ to avoid name clashes with packages such as ‘`matlab`’ that are sticking closer to the original.
- Added ‘`pracma-package`’ section to the manual.

### Changes in Version 0.1-9

- `reshape()`, `repmat()`, and `blkdiag()` matrix functions.
- `combs()` chooses all combinations of `k` elements out of `n`, and `randcomb()` generates a random selection.
- `perms()` generates all permutations, `randperm()` a random permutation.
- Pascal triangle as `pascal()`; `nchoosek()` returns binomial coefficients.
- Some string functions: `streq()`, `strcmpr()`, `strcat()`.

### Changes in Version 0.1-8

- `std()` as refinement of the standard deviation function.
- `ceil()` and `fix()` as aliases for `ceiling()` and `trunc()`. [`floor()` and `round()` already exist in R.]
- Modulo functions `mod()`, `rem()` and integer division `idiv()`.
- Integer functions related to the Euclidean algorithm: `extgcd()`, `gcd()`, `lcm()`, `coprime()`, and `modinv()`.
- `distmat()` and `crossn()`, the vector product in `n`-dimensional space.

**Changes in Version 0.1-7**

- `size()`, `numel()`, `ndims()`, `isempty()`, and `find()`.
- `eye()`, `ones()`, `zeros()`.
- Functions returning random numbers: `rand()`, `randn()`, `randi()`.
- `linspace()`, `logspace()`, and `logseq()` for linearly, logarithmically, and exponentially spaced sequences.

Note that the functions in the ‘matlab’ package are not exactly mimicking the corresponding Matlab/Octave functions.

**Changes in Version 0.1-6**

- Matrix functions `mdiag()` and `mtrace()` added. `inv()` is introduced as an alias for `solve()` in R.
- Generate special matrices `hankel()`, `rosser()`, and `wilkinson()`. `kron()` is an alias for the R function `kronceker()`.
- Renamed `factors()` to `ifactor()` to distinguish it more clearly from `factors` as used in R.

**Changes in Version 0.1-5**

- Added functions for flipping or rotating numeric and complex matrices: `flipdim()`, `flipud()`, `fliplr()`, and `rot90()`.

**Changes in Version 0.1-4**

- Added basic complex functions `real()`, `imag()`, `conj()`, and `angle()` which are essentially only aliases of the R functions `Re()`, `Im()`, and `Conj()`.  
`angle()` returns the angle of a complex number in radians. The R function `Mod()` is here only available as `abs()`.

**Changes in Version 0.1-3**

- Added `companion()` function for the ‘companion’ matrix; the `eig()` function is an alias for the R `eigen()` values function.
- Added the polynomial functions `poly()`, `polyder()`, `polyfit()`, `polyint()`, and `polyval()`.
- `roots()` returns real and complex roots of polynomials.
- Simplified the `trapz()` function.

**Changes in Version 0.1-2**

- Added functions from number theory: `primes()`, `isprime()` and `factors()`.
- The corresponding function for `factors()` in Matlab/Octave is called `factor()`, but that name should not be shadowed in R!
- Added the `polyarea()` and `trapz()` functions.

**Changes in Version 0.1-1**

- Added some simple functions such as `nthroot()`, `pow2()`, and `nextpow2()`.
- `dot()` and `cross()` functions for scalar and vector product.
- Generate matrices through `vander()` and `hilb()`.

**INITIAL VERSION 0.1-0**

**INSTALLATION:** ‘matlab4r’ will be a pure R package without using any source code. Therefore, installation will be immediate on all platforms.

**INTENTION:** This package provides R implementations of more advanced math functions from Matlab and Octave (and the Euler Math Toolbox) with a special view on optimization and time series routines.

**Remark:** Typeset this document as:

```
R CMD Rd2pdf NEWS.Rd --title="NEWS for pracma version 0.6-0".
```



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