

# NEWS for pracma version 1.3.3

December 8, 2012

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NEWS

*pracma News*

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## Changes in Version 1.3.3 (2012-12-09)

- `ezpolar()` easy access to the `polar()` function.
- `who()`, `null()` alias for `nullspace` function (Matlab style).

## Changes in Version 1.3.2 (2012-12-08)

- `ellipke()`, `ellipj()` elliptic and Jacobi elliptic integrals.
- `expint()` implements `E1` and `Ei`, the exponential integrals, with aliases `expint_E1()` and `expint_Ei()`.
- `li()` the logarithmic integral (w/o offset).

## Changes in Version 1.3.1 (2012-12-06)

- Explicitely listing about 185 Matlab-emulating function names.
- Dismissed `matlab()`, using it now for infos only, not assigning Matlab function names to the environment (because of CRAN policies).

## Changes in Version 1.3.0 (2012-12-05)

- `cot()`, `csc()`, `sec()` cotangens, cosecans, and secans functions.
- `acot()`, `acsc()`, `asec()` inverse cotangens, cosecans, secans.
- `coth()`, `csch()`, `sech()` hyperbolic cotangens, cosecans, secans.
- `acoth()`, `acsch()`, `asech()` inverse hyperbolic cotangens, cosecans, and secans functions.

## Changes in Version 1.2.9 (2012-12-02)

- `bvp()` changed to solve second order boundary value problems.
- `trisolve()` solves tridiagonal linear equation systems.
- `curvefit()` fits points in the plane with a polynomial curve.

**Changes in Version 1.2.8 (2012-11-30)**

- lsqlin() least-squares solver with linear equality constraints.
- pinv() now works like MASS::ginv() for singular matrices.
- Added the end-';' feature to str2num().
- toc() added invisible return value.

**Changes in Version 1.2.7 (2012-11-22)**

- procrustes() solving the Procrustes problem, and kabsch() implements the Kabsch algorithm.
- kriging() ordinary and simple Kriging interpolation.
- Corrected some stupid errors in str2num().

**Changes in Version 1.2.6 (2012-11-11)**

- akimaInterp() univariate Akima interpolation.
- Moved transfinite() to package 'adagio'.

**Changes in Version 1.2.5 (2012-09-28)**

- histc() Histogram-like counting (Matlab style).
- Added warning to complexstep() if imaginary part is zero.

**Changes in Version 1.2.4 (2012-10-25)**

- Added option 'pinv' to mldivide() to return the same results as Matlab.
- str2num(), num2str() conversion functions (Matlab style).
- Removed some 'author' entries on help pages.

**Changes in Version 1.2.3 (2012-10-17)**

- Renamed mrank() to Rank().
- Corrected nullspace() [thanks to Stephane Laurent], which now agrees with Octave's null() function (MASS:Null appears buggy, too).
- Corrected gaussNewton() and fsolve() [thanks to Etienne Chamayou].

**Changes in Version 1.2.2 (2012-10-10)**

- bsxfun() apply binary function elementwise (Matlab style).
- added the analytic solution for the example in bvp().

**Changes in Version 1.2.1 (2012-09-28)**

- rosenbrock() added, moved testfunctions to 'adagio' package.
- euler\_heun() improved Euler method for solving ODEs.
- logit() function added to sigmoid().
- Keyword 'ode' introduced.

**Changes in Version 1.2.0 (2012-09-27)**

- matlab() can reinstall Matlab function names.

**Changes in Version 1.1.9 (2012-09-25)**

- gcd(), lcm() greatest common divisor, least common multiple now working on a vector of integers.
- Removed number-theoretic functions: eulersPhi(), moebiusFun(), mertensFun(), sigma(), tau(), omega(), Omega(), primes2(), twinPrimes(), nextPrime(), previousPrime(), modpower(), modorder(), modinv(), modlin(), agm(), primroot(), contfrac(), coprime(), GCD(), LCM(), extGCD(), (these functions are now available in the 'numbers' package).

**Changes in Version 1.1.8 (2012-09-19)**

- ezcontour(), ezmesh() wrappers for contour(), image(), persp().
- erfi() imaginary error function.

**Changes in Version 1.1.7 (2012-08-06)**

- moler() Moler matrix

**Changes in Version 1.1.6 (2012-07-20)**

- Removed '.Rapphistory' from the tests directory (again) [and use "--as-cran" for the checks].
- disp() display text or array (Matlab Style), cat() with newline.

**Changes in Version 1.1.5 (2012-07-18)**

- Renamed functions with capital first letter to avoid name clashes: And/Or, mtrace -> Trace, mdiag -> Diag, strtrim -> strTrim, reshape -> Reshape, find -> Find, fix -> Fix, mode -> Mode, real -> Real, imag -> Imag, hadamard -> Hadamard, toeplitz -> Toeplitz, poly -> Poly.

**Changes in Version 1.1.4 (2012-06-26)**

- gammainc() (lower and upper) incomplete gamma function, also the regularized gamma function, all allowing negative x values.
- polylog() the polylogarithm functions for  $|z| < 1$  and  $n \geq -4$ .

**Changes in Version 1.1.3 (2012-06-17)**

- fminsearch() implements Nelder-Mead (similar to optim), and Fletcher-Powell when "dfree=FALSE" is chosen.
- Test functions rosenbrock(), rastrigin(), and many more.

**Changes in Version 1.1.2 (2012-06-13)**

- nelder\_mead() implements Nelder-Mead for nonlinear optimization.
- hooke-jeeves() Hooke-Jeeves algorithm for direct search.
- fletcher\_powell() Davidon-Fletcher-Powell method for function minimization (alternative to BFGS approach).
- steepest\_descent() minimization of functions using steepest descent.

**Changes in Version 1.1.1 (2012-06-10)**

- `fminbnd()` implements Brent's function minimization algorithm with golden section search and parabolic interpolation (same as `optimize`).
- `transfinite()` transformation function between bounded and unbounded (box constraint) regions.
- renamed `brentDekker()` to `brent_dekker`

**Changes in Version 1.1.0 (2012-06-06)**

- `hurst()`, `hurstexp()` calculate the Hurst exponent of a time series.
- Updated the NEWS.Rd file.

**Changes in Version 1.0.9 (2012-06-03)**

- `lsqnonneg()` solves nonnegative least-squares problems by using the trick " $x \rightarrow \exp(x)$ " and applying `lsqnonlin()`; example function `lsqcurvefit()` for nonlinear curve fitting.
- Renamed `ridder()` to `ridders()`, thanks to Robert Monfera for pointing it out (he also suggested a multi-dimensional variant).

**Changes in Version 1.0.8 (2012-05-22)**

- `movavg()` moving average of types "simple", "weighted", "modified", "exponential" (EMA), or "triangular".
- `modlin()` solves modular linear equations.

**Changes in Version 1.0.7 (2012-05-11)**

- `lsqnonlin()` solves nonlinear least-squares problems using the Levenberg-Marquardt approach.
- renamed `froots()` to `findzeros()`, and `fmins()` to `findmins()`.

**Changes in Version 1.0.6 (2012-04-21)**

- `fornberg()` finite difference (i.e., polynomial) approximation of derivatives for unevenly spaced grid points – Fornberg's method.

**Changes in Version 1.0.5 (2012-04-15)**

- `randsample()` randomly sampling, alias for `sample` (Matlab style).
- `rands()` generates uniform random points on an N-sphere.
- Added `tic()`, `toc()` measuring elapsed time (Matlab style).
- `previousPrime()` finds the next prime below a number.

**Changes in Version 1.0.4 (2012-04-01)**

- `invlap()` computes the inverse Lapacian numerically.
- `ppfit()` piecewise polynomial fitting procedure.

**Changes in Version 1.0.3 (2012-03-21)**

- `cubicspline()` interpolating cubic spline (w/ endpoint conditions).
- `mkpp()` and `ppval()` for piecewise polynomial structures.

**Changes in Version 1.0.2 (2012-03-17)**

- `accumarray()` resembles the related Matlab function more closely.
- `invperm()` returns the inverse of a permutation.
- `randperm()` changed to make it more Matlab-like.

**Changes in Version 1.0.1 (2012-03-09)**

- `agm()` example computes pi to an arbitrary number of decimal digits using the Rmpfr package for variable precision arithmetic.
- `plotyy()` corrected right ordinate, prettying the labels.
- `peaks()` peaks function (Matlab style).

**Changes in Version 1.0.0 (2012-03-01)**

- Updated the NEWS.Rd file.

**Changes in Version 0.9.9 (2012-01-29)**

- `qrSolve` solves overdetermined system of linear equations.
- `DSCsearch()` removed, now in package ‘pracopt’.
- `randp()` found a better, non-selective approach.

**Changes in Version 0.9.8 (2012-02-23)**

- `gramSchmidt()` modified Gram-Schmidt process.
- `householder()` Householder reflections and QR decomposition.
- `givens()` Givens rotation and QR decomposition.
- corrected a small error in `ridder()` (thanks to Roger Harbord).

**Changes in Version 0.9.7 (2012-02-17)**

- `erf()` corrected, `erfc()` and `erfcx()` as new functions, including their inverses `erfinv()` and `erfcinv()`.
- `hypot()` now numerically more stable (thanks to Jerry Lewis).

**Changes in Version 0.9.6 (2012-01-25)**

- Changed third example for `dblquad()` [new Windows toolchain problem].
- Deactivated the test for `gammaz()` because of problems on Solaris.

**Changes in Version 0.9.5 (2012-01-16)**

- `kmeanspp()` kmeans++ clustering algorithm.
- `savgol()` and `hampel()` with new options, fuelled by a blog entry of Ron Pearson in his ExploringDataBlog.

**Changes in Version 0.9.4 (2012-01-08)**

- DSCsearch() Davies-Swann-Campey search in one dimension.
- Improved modpower() through modular exponentiation. Added lehmann\_test() Lehmann's primality test as example.
- Corrected polar() and andrewsplot().

**Changes in Version 0.9.3 (2011-12-27)**

- direct1d() one-dimensional version of the DIRECT algorithm for global function minimization.

**Changes in Version 0.9.2 (2011-12-26)**

- ApEn() approximate entropy of a time series.
- cirshift() circularly shifting arrays (Matlab Style).

**Changes in Version 0.9.1 (2011-12-12)**

- plotyy() plots curves with y-axes on both left and right side.
- fplot() plots components of a multivariate function.

**Changes in Version 0.9.0 (2011-12-11)**

- errorbar() routine for plotting error bars in both directions.
- Whittaker-Henderson smoothing \*\* Not yet running\*\* .
- rref() reduced row echelon form.

**Changes in Version 0.8.9 (2011-12-08)**

- cutpoints() automatically finds cutting points based on gaps.
- hausdorff\_dist calculates the Hausdorff distance / Hausdorff dimension.
- nnz() number of non-zeros elements (Matlab style).

**Changes in Version 0.8.8 (2011-12-06)**

- polar() for polar plots (Matlab style), see the example plots.
- andrewsplot() plots Andrews curves in polar coordinates.
- Vectorized: cart2sph(), sph2cart(), cart2pol(), pol2cart().

**Changes in Version 0.8.7 (2011-11-30)**

- deg2rad(), rad2deg()
- figure() Matlab style, and pltcross() plotting crosses.

**Changes in Version 0.8.6 (2011-11-21)**

- ridder() Ridder's method for zero finding of univariate functions.

**Changes in Version 0.8.5 (2011-11-19)**

- `sqrtm()` matrix square root, based on Denman-Beavers iteration, `rootm()` matrix p-th root, computing a complex contour integral, `signm()` matrix sign function.
- `fzero()` now uses the new `zeroIn()` function, i.e., a Brent-Dekker approach instead of referring to `uniroot()`.
- `twinPrimes()` twin primes in a given interval, and `nextPrime` will find the next higher prime.

**Changes in Version 0.8.4 (2011-11-14)**

- Transformations between cartesian, spherical, polar and cylindrical coordinate systems: `cart2sph()`, `sph2cart()`, `cart2pol()`, `pol2cart()`.
- `polar()` uniformly random points in the unit circle (till Matlab 5).

**Changes in Version 0.8.3 (2011-11-11)**

- `accumarray()` grouping elements and applying a function to each group.
- `uniq()` Matlab-style ‘unique’ function, `allsums()` in the examples.
- small correction to `fsolve()`, mentioned on the ‘check summary’ page.

**Changes in Version 0.8.2 (2011-11-04)**

- `newmark()` Newmark’s method for solving second order differential equations of the form  $y''(t) = f(t, y(t), y'(t))$  on  $[t1, t2]$ .
- `cranknic()` Crank-Nicolson ‘ivp’ solver, combining the forward and backward Euler methods for ordinary differential equations.

**Changes in Version 0.8.1 (2011-10-30)**

- Corrected `pinv()` for (nearly) singular matrices.
- Renamed `ifactor()` to `factors()`.

**Changes in Version 0.8.0 (2011-10-27)**

- Minor corrections and improvements to the ‘pracma.pdf’ manual, incl. `numdiff()`, `reFindall()`, `trigApprox()`, and `subspace()`.

**Changes in Version 0.7.9 (2011-10-22)**

- `spinterp()` monotonic (and later on shape-preserving) interpolation following the approach of Delbourgo and Gregory.

**Changes in Version 0.7.8 (2011-10-17)**

- `bvp()` solves boundary value problems of the following kind:  
 $-u''(x) + c1 u'(x) + c2 u(x) = f(x)$  for  $x$  in  $[a, b]$ .

**Changes in Version 0.7.7 (2011-10-14)**

- `primes2(n1, n2)` will return all prime numbers between  $n1$  and  $n2$  (without storing the numbers from `sqrt(n2)` up to  $n1$ ).

**Changes in Version 0.7.6 (2011-08-05)**

- gaussNewton() for function minimization and solving systems of nonlinear equations. fsolve() as a wrapper for it.
- fzsolve() for root finding of complex functions.
- softline() Fletcher's inexact linesearch algorithm.

**Changes in Version 0.7.5 (2011-07-26)**

- Put NEWS.Rd in the /inst subdirectory (and NEWS.pdf in /doc), thanks to Kurt Hornik; slightly changed the version numbering.

**Changes in Version 0.7.4 (2011-07-22)**

- rortho() generate random orthogonal matrix of size n.
- Titanium data set for testing fitting procedures.

**Changes in Version 0.7.3 (2011-07-15)**

- erf() and erfc() error and complementary error functions (Matlab style) as (almost) aliases for pnorm().
- erfz() complex error function.

**Changes in Version 0.7.2 (2011-07-11)**

- broyden() quasi-Newton root finding method for systems of nonlinear equations.

**Changes in Version 0.7.1 (2011-07-09)**

- cross() has been vectorized (remark on R-help).

**Changes in Version 0.7.0 (2011-07-07)**

- Sigmoid and Einstein functions.

**Changes in Version 0.6.9 (2011-07-06)**

- Runge-Kutta-Fehlberg method of order (5,4).

**Changes in Version 0.6.8 (2011-07-05)**

- triquad() Gaussian quadrature over triangles.
- cotes() Newton-Cotes integration formulae for 2 to 8 nodes.

**Changes in Version 0.6.7 (2011-07-04)**

- lagrangeInterp(), newtonInterp() Lagrange and Newton polynomial interpolation, neville() Neville's methods.
- tril(), triu() extracting triangular matrices (Matlab style).



**Changes in Version 0.6.6 (2011-07-02)**

- `charpoly()` computes the characteristic polynomial, the determinant, and the inverse for matrices that are relatively small, applying the Faddejew-Leverrier method.
- `froots()` to find \*all\* roots (also of second or higher order) of a univariate function in a given interval. The same with `fmins()` to find all minima.

**Changes in Version 0.6.5 (2011-07-01)**

- Adams-Bashford and Adams-Moulton (i.e., multi-step) methods for ordinary differential equations in function `abm3pc()`.

**Changes in Version 0.6.4 (2011-06-30)**

- Changed the description to be more precise about the package.

**Changes in Version 0.6.3 (2011-06-28)**

- `rationalfit()` rational function approximation
- `ratinterp()` rational interpolation a la Burlisch-Stoer.

**Changes in Version 0.6.2 (2011-06-26)**

- `pade()` Pade approximation.

**Changes in Version 0.6.1 (2011-06-25)**

- `quadgk()` adaptive Gauss-Kronrod quadrature.

**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).

**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.
- `rmsserr()` 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, `mrnk()`, 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 `complexstepJ()`.

**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()`, `regexpi()`, `regexprep()` and `refindall()`.

**Changes in Version 0.2.6**

- String functions `blanks()`, `strtrim()`, `deblank()`, `strjust()`, and `strep()`.
- `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 `mod-power()` 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()`.

**Changes in 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: `strcmp()`, `strcmpi()`, `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 `kronecker()`.
- 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 `compan()` 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()`.

**Changes in Version 0.1.0**

- Installation  
‘pracma’ will be a pure R package without using source code in C or Fortran. 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 1.3.3".`

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