

NEWS for pracma version 1.5.3

August 26, 2013

NEWS

pracma News

Changes in Version 1.5.3 (2013-08-25)

- `arclength()` length of a parametrized curve in n-dimensional space, w/ improved convergence by applying Richardson's extrapolation method.
- `legendre()` associated Legendre functions.

Changes in Version 1.5.2 (2013-08-23)

- `polycenter()` calculates the center coordinates of a polygon.
- `polylength()` calculates the (euclidean) length of a polygon.
- `polyarea()` corrected, returns the true, not the absolute value.

Changes in Version 1.5.1 (2013-08-19)

- `fsolve()` will use `broyden()` if $m = n$; `fzsolve()` the same; additionally, improved `broyden()` and `gaussNewton()`.
- `ezplot()` can draw markers on the line, with equal distances measured along the curve length.

Changes in Version 1.5.0 (2013-08-08)

- `gmres()` generalized minimum residual method.
- `nearest_spd()` find nearest symmetric positive-definite matrix.
- `eps()` floating point relative accuracy.

Changes in Version 1.4.9 (2013-07-16)

- `lapacian()` now works in n dimensions, not only for $n=2$.
- `mldivide()`, `mrdivide()` corrected a severe typo.
- `numderiv()`, `numdiff()` start with $h = 1/2$ instead of $h = 1$.
- `figure()` platform-independent by using `dev.new()`.

Changes in Version 1.4.8 (2013-06-17)

- `findzeros()` now finds ‘quadratic’ roots, too.
- `fsolve()` will use `newtonsys()` if $m = n$.
- `pdist2()` added as an alias for `distmat()`, while `pdist(X)` now is `distmat(X, X)` (Matlab style).

Changes in Version 1.4.7 (2013-05-20)

- `histcc()` histogram with optimized number of bins.
- Example of correction term for the `trapz()` integration.

Changes in Version 1.4.6 (2013-03-31)

- `psi()` Psi polygamma function (Matlab style).
- `rosenbrock()` and `rastrigin()` functions removed.

Changes in Version 1.4.5 (2013-03-21)

- `quadcc()` iterative/adaptive Clenshaw-Curtis quadrature.
- `squareform()` formats distance matrix (Matlab style).

Changes in Version 1.4.4 (2013-02-12)

- `integral2()` implements the two-dimensional numerical integration approach ‘TwoD’, i.e. Gauss-Kronrod (3, 7)-points on rectangles.
- `integral3()` three-dimensional integration based on `integral2()`.
- `triplequad()` 3-dim. integration based on `dblquad()` (Matlab style).

Changes in Version 1.4.3 (2013-03-10)

- `integral()` combines adaptive numerical integration procedures.
- `cintegral()` complex line integrals (rectangles and curves).

Changes in Version 1.4.2 (2013-03-03)

- `linprog()` linear programming solver for linear equality and inequality constraints.

Changes in Version 1.4.1 (2013-02-20)

- `romberg()` Romberg integration completely rewritten.
- `idivide()` integer division with different roundings.

Changes in Version 1.4.0 (2013-02-10)

- `fderiv()`, `taylor()` expanded to higher orders.
- `itersolve()` iteration methods for solving linear systems.
- `lu()` LU decomposition with different schemes (w/o pivoting).

Changes in Version 1.3.9 (2013-01-26)

- pdist() as an alias for distmat() (Matlab style).
- fftshift(), ifftshift() shifting Fourier frequencies.
- Improved grad(), jacobian(), hessian(), and laplacian().

Changes in Version 1.3.8 (2013-01-10)

- Smaller corrections; no startup messages anymore.
- geomean(), harmmean(), trimmean() geometric, harmonic, and trimmed arithmetic mean (Matlab style).
- agmean() algebraic-geometric mean.

Changes in Version 1.3.7 (2013-01-07)

- mexpfit() multi-exponentiell fitting.

Changes in Version 1.3.6 (2013-01-06)

- lsqsep() separable least-squares fitting.
- lsqcurvefit() nonlinear least-squares curve fitting.

Changes in Version 1.3.5 (2013-01-05)

- cd(), pwd() directory functions (Matlab style).
- rand(), randn() changed to accept size() as input.
- whos(), what() corrected for empty lists resp. directories.

Changes in Version 1.3.4 (2012-12-19)

- what(), who(), whos(), ver() (Matlab style).
- semilogx(), semilogy(), loglog() logarithmic plots (Matlab style)

Changes in Version 1.3.3 (2012-12-12)

- quadv() vectorized integration.
- ezpolar() easy access to the polar() function.
- sortrows() sorting rows of matrices (Matlab style).
- null() alias for nullspace function (Matlab style).
- eigjacobian() Jacobi's method for eigenvalues and eigenvectors.

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 200 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(), asech() 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)

- lsqin() 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 `mrnk()` 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()`, `primroot()`, `confrac()`, `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)

- `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 `zeroim()` 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 $[t_1, t_2]$.
- `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:
 $-u''(x) + c_1 u'(x) + c_2 u(x) = f(x)$ 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 end-points 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.

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.
- `rmse()` 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)

- 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 $\mathbb{R}^n \rightarrow \mathbb{R}^m$ as simple numerical derivative.
- `newtonsys()` applies Newton’s method to functions $\mathbb{R}^n \rightarrow \mathbb{R}^n$ 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 `kroncker()`.
- 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 1.5.3".`

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