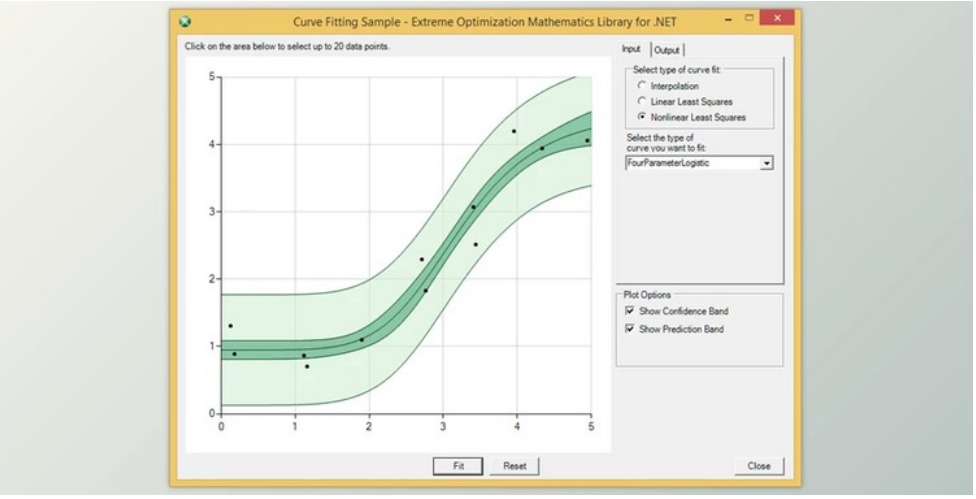
Extreme Optimization Numerical Libraries for .NET v8.1.9 (12 Sep 2022)

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The Extreme Optimization Numerical Libraries for .NET are an assortment of general-purpose mathematical and statistical classes designed specifically for Microsoft's Microsoft .NET Framework.

Extreme Optimization Numerical Libraries for .NET is a collection of general-purpose math and statistical courses. It is a complete statistical and technical computing platform built on the Microsoft .NET platform. It includes the math library, vector and matrix library, and a statistics library in a straightforward package.

Extreme Optimization Numerical Libraries for .NET Great Features:

- Easy to use even for the mathematically not-so-inclined.
- Excellent performance through optimized implementation of the best algorithms.
- Powerful enough to satisfy the most demanding power user.
- Intuitive object model. The objects in the Extreme Optimization Numerical Libraries for .NET and the relationships between them match our everyday concepts.
- Cross-platform. Works out-of-the-box on 32 and 64-bit platforms, .NET versions 1.1, 2.0, 3.0, and 3.5.

- General
  - Machine floating-point constants.
  - Common mathematical constants.
  - It extended elementary functions.
  - Algorithm support functions: iteration, tolerance, convergence tests.
- Complex numbers
  - Double-precision complex number value type.
  - Overloaded operators for all arithmetic operations.
  - Static operator functions for languages that don't support operator overloading.
  - Extension of functions in the System.Math to the complex argument.
  - Support for complex infinity and complex Not-a-Number (NaN).
  - Complex vector and matrix classes.
- Numerical integration and differentiation
  - Numerical differentiation.
  - Numerical integration using Simpson's rule and Romberg's method.
  - Non-adaptive Gauss-Kronrod numerical integrator.
  - Adaptive Gauss-Kronrod numerical integrator.
  - Integration over infinite intervals.
  - Optimizations for functions with singularities and discontinuities.
  - Six integration rules to choose from, or provide your own.
  - Integration in 2 or more dimensions.
- Curve fitting and interpolation
  - Interpolation using polynomials, cubic splines, piecewise constant, and linear curves.
  - Linear least squares fit using polynomials or arbitrary functions.
  - Nonlinear least squares using predefined functions or your own.
  - Predefined nonlinear curves: exponential, rational, Gaussian, Lorentz, 4 and 5 parameter logistic.
  - I weighted least squares with four predefined weight functions.
  - I am scaling curve parameters.
  - Constraints on curve parameters.
- Curves
  - An object-oriented approach to working with mathematical curves.

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标签

Components Other .Net

    - Methods for: evaluation, derivative, definite integral, tangent, roots.
    - Many basic types of curves: constants, lines, quadratics, polynomials, cubic splines, Chebyshev approximations, and linear combinations of arbitrary functions.
- Solving equations
    - Real and complex roots of polynomials.
    - Roots of arbitrary functions: bisection, false positive, Dekker-Brent, and Newton-Raphson methods.
    - Systems of simultaneous linear equations.
    - Systems of nonlinear equations: Powell's hybrid 'dogleg' method, Newton's method.
    - Least squares solutions.
- Optimization
    - Optimization in 1 dimension: Brent's algorithm, Golden Section search.
    - The quasi-Newton method in N dimensions: BFGS and DFP variants.
    - Conjugate gradient method in N dimensions: Fletcher-Reeves and Polak-Ribière variants.
    - Powell's conjugate gradient method.
    - Downhill Simplex method of Nelder and Mead.
    - Levenberg-Marquardt method for nonlinear least squares.
    - Line search algorithms: Moré-Thuente, quadratic, unit.
    - Linear program solver: Based on the Revised Simplex method.
    - Linear program solver: Import from MPS files.
- Signal processing
    - Accurate 1D and 2D Fast Fourier Transform.
    - Complex 2D Fast Fourier Transform.
    - Unique code for factors 2, 3, 4, and 5.
    - Real and complex convolution.
    - Managed 32bit and 64bit native implementations.
- Special functions
    - Over 40 special functions are not included in the standard .NET Framework class library.
    - Functions from combinatorics: factorial, combinations, variations, and more.
    - Functions from number theory: greatest common divisor, least common multiple, decomposition into prime factors, primality testing.
    - Gamma and related functions include incomplete and regularized digamma, beta, and harmonic numbers.
    - Hyperbolic and inverse hyperbolic functions for real and complex numbers.
    - Ordinary and Modified Bessel functions of the first and second kind.
    - Airy functions and their derivatives.
    - Exponential integral, sine and cosine integral, and logarithmic integral.

- General
    - Single, double, or quad precision absolute or complex components.
    - Based on standard BLAS and LAPACK routines.
    - 100% managed implementation for security, portability, and small sizes.
    - Native, processor-optimized implementation for speed with large sizes based on the Intel® Math Kernel Library.
    - Native 64bit support.
- GPU computing
    - GPU computing: offload computations to the GPU.
    - Data is kept on the GPU as long as possible for optimal performance.
- Vectors
    - Dense vectors.
    - Band vectors.
    - Constant vectors.
    - Row, column, and diagonal vectors.
    - Vector views.
- Vector Operations
    - Basic arithmetic operations.
    - Element-wise operations.
    - They overloaded arithmetic operators.
    - Norms, dot products.
    - Most significant and smallest values.
    - Functions of vectors (sine, cosine, etc.)
- Matrices
    - General matrices.
    - Triangular matrices.
    - Real symmetric matrices and complex Hermitian matrices.
    - Band matrices.
    - Diagonal matrices.
    - Matrix views.
- Matrix Operations
    - Basic arithmetic operations.
    - Matrix-vector products.
    - They overloaded arithmetic operations.
    - Element-wise operations.
    - Row and column scaling.
    - Norms, rank, condition numbers.

    - Singular values, eigenvalues, and eigenvectors.
- Matrix Decompositions
    - LU decomposition.
    - QR decomposition.
    - Cholesky decomposition.
    - Singular value decomposition.
    - Symmetric eigenvalue decomposition.
    - Non-symmetric eigenvalue decomposition.
    - Banded LU and Cholesky decomposition.
- Sparse Matrices
    - Sparse vectors.
    - Sparse matrices.
    - Matrices in Compressed Sparse Column format.
    - Sparse LU Decomposition.
    - Read matrices in Matrix Market format.
- Linear equations and least squares
    - Shared API for matrices and decompositions.
    - Determinants, inverses, numerical rank, condition numbers.
    - Solve equations with one or multiple right-hand sides.
    - Least squares solutions using QR or Singular Value Decomposition.
    - Moore-Penrose Pseudo-inverse.
    - Non-negative least squares (NNLS).

- Descriptive Statistics
    - Measures of central tendency: mean, median, trimmed mean, harmonic mean, geometric mean.
    - Measures of scale: variance, standard deviation, range, interquartile range, absolute deviation from mean and median.
    - Higher moments: skewness, kurtosis.
- Probability Distributions
    - Probability density function (PDF).
    - Cumulative distribution function (CDF).
    - Percentile or inverse cumulative distribution function.
    - Moments: mean, variance, skewness, and kurtosis.
    - Generate random samples from any distribution.
    - Parameter estimation for selected distributions.
- Continuous Probability Distributions
    - Beta distribution.
    - Cauchy distribution.
    - Chi-squared distribution.
    - Erlang distribution.
    - Exponential distribution.
    - F distribution.
    - Gamma distribution.
    - You generalized Pareto distribution.
    - Gumbel distribution.
    - Laplace distribution.
    - Logistic distribution.
    - Lognormal distribution.
    - Normal distribution.
    - Pareto distribution.
    - Piecewise distribution.
    - Rayleigh distribution.
    - Student t distribution.
    - She transformed beta distribution.
    - She transformed gamma distribution.
    - Triangular distribution.
    - Uniform distribution.
    - Weibull distribution.
- Discrete Probability Distributions
    - Bernoulli distribution.
    - Binomial distribution.
    - Geometric distribution.
    - Hypergeometric distribution.
    - Negative binomial distribution.
    - Poisson distribution.
    - Uniform distribution.
- Multivariate Probability Distributions
    - Multivariate normal distribution.
    - Dirichlet distribution.
- Histograms
    - One-dimensional histograms.
    - Probability distribution associated with a histogram.

- General Linear Models
  - Infrastructure for General Linear Model and Generalized Linear Model calculations.
  - Analysis of variance.
  - Regression analysis.
  - Model-specific hypothesis tests.
- Analysis of variance (ANOVA)
  - One and two-way ANOVA.
  - One-way ANOVA with repeated measures.
- Regression analysis
  - Simple, multiple, and polynomial regression.
  - Nonlinear regression.
  - Logistic regression.
  - You generalized linear models.
  - Flexible regression models.
  - Variance-covariance matrix, regression matrix.
  - Confidence intervals and significance tests for regression parameters.
- Time series analysis
  - Treat several observation variables as a unit.
  - Change the frequency of the time series.
  - Automatically apply predefined aggregators.
  - Advanced aggregators: volume weighted average.
- Transformations of Time Series Data
  - It lagged time series, sums, and products.
  - Change, percent change, growth rate.
  - Extrapolated change, percent change, growth rate.
  - Period-to-date sums and differences.
  - Simple, exponential, weighted moving average.
  - Savitsky-Golay smoothing.
- Multivariate Models
  - Principal Component Analysis (PCA).
  - Hierarchical clustering.
  - K-means clustering.
- Statistical tests
  - Tests for the mean: one sample z-test, one sample t-test.
  - Paired and unpaired two-sample t-test for the difference between two sample means.
  - Two Sample z-test for ratios.
  - One sample chi-squared test for variance.
  - F-test for the ratio of two variances.
  - One and two sample Kolmogorov-Smirnov test.
  - Anderson-Darling test for normality.
  - Chi-squared goodness-of-fit test.
  - Bartlett and Levene tests for homogeneity of variances.
  - McNemar and Stuart-Maxwell test.
- Random number generation
  - Compatible with the .NET Framework's System.Random.
  - Four generators with varying quality, period, and speed to suit your application.
  - Generate random samples from any distribution.
  - Fauré and Halton sequences.
  - Shufflers and randomized enumerators.

版本列表

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