

ETBX

ENGINEERS TOOLBOX

Rapid solutions for engineering design and analysis

Overview

EngineersToolbox (**ETBX**) is a desktop software product for engineering design and analysis. **ETBX** features integrated computational modules that provide rapid solutions to typical engineering systems and scenarios. The **ETBX** module library covers a range of engineering specialties, including:

- Solid Mechanics
- Dynamics and Controls
- Fatigue and Fracture Mechanics
- Numeric Methods
- Reference Data And Utilities

The **ETBX** system accelerates the design and evaluation process by combining rapid analysis with advanced graphics capabilities. The intuitive **ETBX** interface allows the engineer to interactively explore ideas during a design or evaluation study. The system encourages investigation and makes it easy to quickly compare design alternatives that can lead to early insights and competitive advantages. Engineering professionals worldwide use **ETBX** to speed product development and analysis, reduce project costs, and produce effective solutions.

Solutions

The **ETBX** module library captures years of experience and expertise from numerous sources. Solution methodologies are documented in an integrated HTML-based reference system and are based on respected engineering practices: first-

principles, empirical correlations, experimental data, rules-of-thumb, and numerical evaluation of conservation equations.

ETBX solution types include:

- Static deflection and stress calculations
- Natural frequencies and mode shapes
- Dynamic simulation of linear and nonlinear systems.
- Transient response
- Frequency response

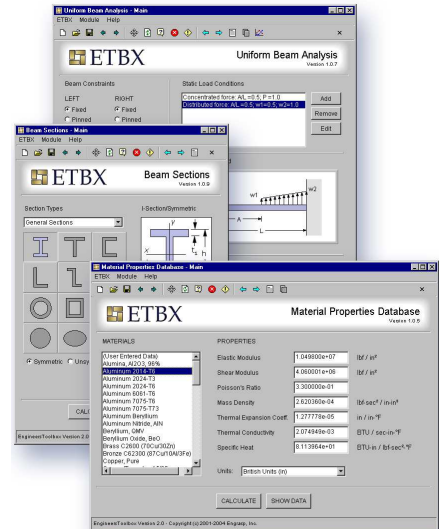
Graphics

ETBX includes the specialized graphics required in engineering. From two-dimensional line plots of numerical data to three-dimensional animations of analytical models, **ETBX** provides the visual capabilities that help engineers understand complex systems. Like most aspects of the **ETBX** environment, **ETBX** graphics can be extensively customized to produce high-quality output for written and live presentations.

Environment

The **ETBX** desktop product conveniently packages the entire **ETBX** solution library on your personal computer. The **ETBX** desktop permits easy access to hardware resources to save and print data files and calculated results. It also includes comprehensive documentation in an HTML-based help system that is readily available from every **ETBX** module.

For more information about **ETBX**, visit www.engrasp.com.



Key features

- Provides rapid solutions to common engineering systems and scenarios using an integrated library of advanced computational modules
- Captures years of experience and expertise from numerous respected engineering sources
- Features integrated engineering reference data that can be accessed at the click of a button
- Promotes interactive investigation of design alternatives using an intuitive visual interface
- Features specialized graphics capabilities for engineers, including two-dimensional charting of numerical data and three-dimensional animations of analytical models
- Includes comprehensive documentation and reference information in an HTML-based help system

Solution Library

The **ETBX** solution library consists of 29 modules and continues to grow. The library is partitioned into 5 analysis packages:

- **Solid Mechanics** - Static stresses, strains, deflections; natural frequencies and mode shapes
- **Dynamics and Controls** - Dynamic and control system properties and system response
- **Fatigue and Fracture Mechanics** - Stress concentrations, fatigue life, and crack formation and propagation
- **Numeric Methods** - Numeric algorithms, matrix methods, root-finding and equation-solving
- **Reference Data And Utilities** - Reference data such as material properties, geometric properties, and unit conversions

Modeling

The intuitive **ETBX** interface speeds the process of creating analytical models and defining input parameters. It's consistent, page-based format offers the familiarity of an engineering handbook. **ETBX** modules contain convenient links to integrated engineering reference data such as material properties and unit conversion factors. Interactive three-dimensional graphics capabilities allow you to visually inspect your models.

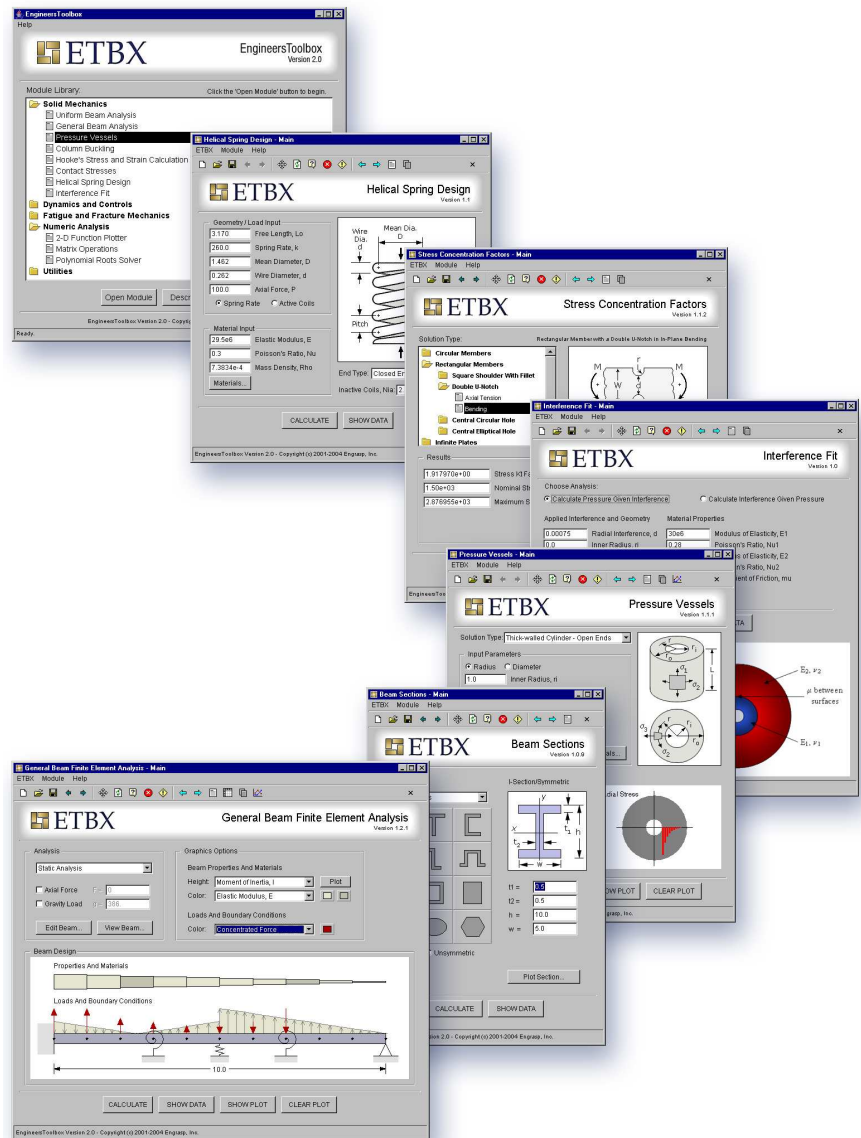
Analysis

Choose a solution type, define input variables, and quickly iterate to your optimal design. **ETBX** checks your model and automatically formulates and solves the applicable engineering equations. All **ETBX** algorithms have been thoroughly checked for accuracy by our experienced staff of research engineers and have been validated by thousands of **ETBX** users worldwide.

Results

ETBX can output calculated results in numerous data formats for presentation and documentation. For example:

- Standard text-based engineering reports provide a comprehensive summary of the input parameters and numerical results.
- Interactive charting capabilities include support for customized two-dimensional line plots.



- Integrated three-dimensional graphics for deformed views and animations of analytical models.
- related to computational modules are quickly made available to **ETBX** users.

Documentation

ETBX provides complete documentation in an HTML-based help system. The documentation contains basic instructions on how to use **ETBX** as well as detailed reference information for all computational modules.

Technical Support

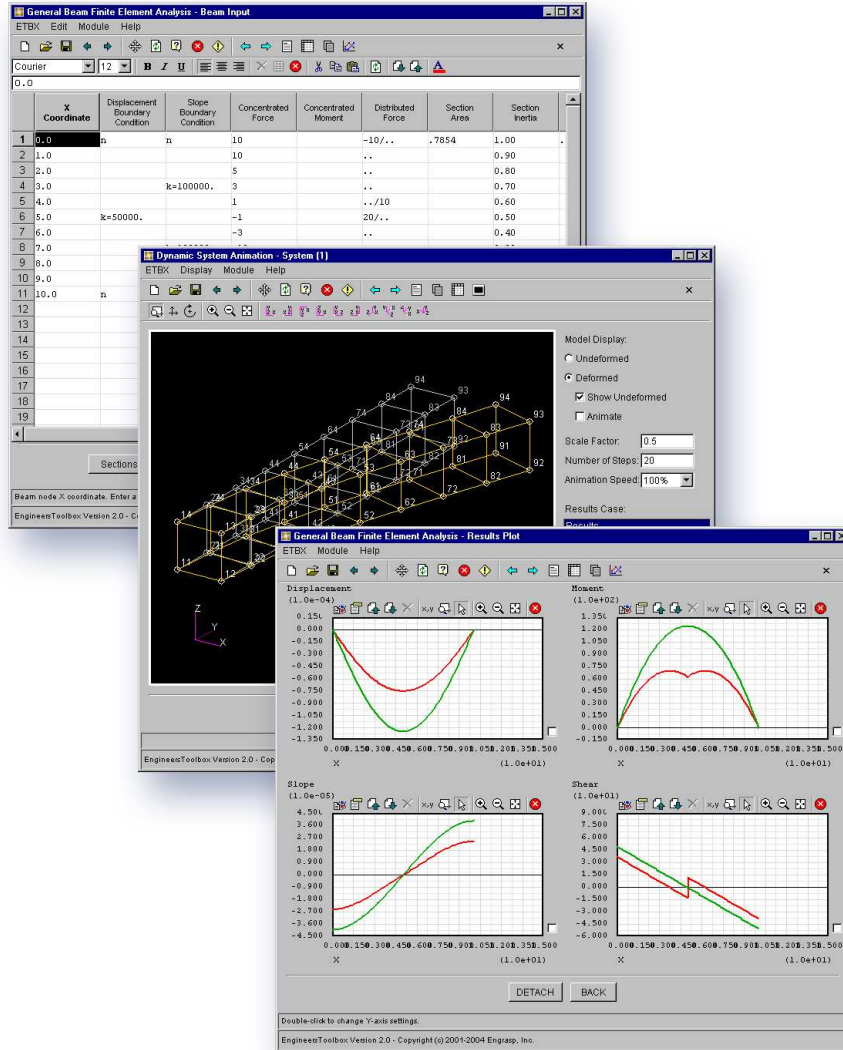
ETBX has a proven track record with thousands of users worldwide. Technical support is readily available, and feedback submitted by the **ETBX** user community receive immediate attention from our support staff. Updates to the **ETBX** software to resolve issues

System Requirements

The **ETBX** desktop product has the following minimum hardware and software requirements:

- Windows XP, 2000, NT, Me, 98
- 500 MHz Intel Pentium III processor or equivalent
- 256 MB RAM (512 MB recommended)
- 60 MB available disk space
- Display resolution of 800x600 pixels (1024x768 is recommended)
- An internet connection is required to activate this product prior to first use. For details, please visit the Engrasp web site.

What our customers are saying



What our customers are saying

"You guys have done an absolutely incredible job... I have been doing application development for structural analysis myself and you people sure have the bar set pretty high!"

"I love ETBX. I use it as a starting point for some of my projects. It has helped me to choose preliminary materials and component sizes, then from there I refine my own calculations."

"I've only been using this utility for a couple of days, but I'm extremely impressed with the ease of use as well as the wide range of functions."

"I hope my students will take best advantage of this tool box. I teach Machine Design and also will be using ETBX...."

"Although I have not even scratched the surface of all that can be done with the ETBX, I'm excited that it is out there and have to say it is awesome...."

"I am very impressed with ETBX and have passed it along to the design engineers who work under me... Keep up the good work!"

"As a college student about to graduate I wish that I had run across this earlier! I am currently using ETBX in a senior design course. The calculations it produces have surely saved me hours upon hours of hand calculations. Thank you very much! I'll be spreading the word."

"I love the package. It is simple, straightforward. I love it."

"The EngineersToolbox is an absolutely marvelous idea and contains a really useful group of tools."

"I found ETBX to be helpful when counter-checking solutions to problems... I love the interface and how your software works."

"I was very impressed with the ease and function of ETBX."

"I teach several CAD and product design courses... and I will ask my students to use ETBX."

"I work as design engineer in a French firm that is specialized in heavy lifting appliances. I'm very impressed by the whole work you made. It is really great that so many modules are already available."

Engrasp, Inc.

Engrasp and its professional team of advanced degree engineers are focused on the development of engineering solutions. Engrasp is dedicated to providing the engineering community with state-of-the-art software that delivers practical engineering solutions using the latest advances in computer interfaces and connectivity. The ETBX desktop platform showcases Engrasp's commitment to its customers by accelerating the development of advanced multidisciplinary software as well as improved documentation and customer support.

Learn more about Engrasp by visiting the Engrasp web site at www.engr.asp.com.

Services

The Engrasp Services organization can help you maximize the value of your ETBX investment. ETBX services include:

- Software support and maintenance packages
- Custom development of ETBX computational modules, built to your specifications and integrated into the ETBX solution library
- Web installations of ETBX on your company or university intranet

Engrasp welcomes the opportunity to discuss the challenges facing your business. For additional information, contact us via the web at www.engr.asp.com/services.

Solid Mechanics Library

- **Uniform Beam Analysis** - Evaluates closed form solutions for single-span uniform beams with various boundary conditions subject to a combination of transverse forces and moments. Calculations include static displacements, rotations, shears, moments, stresses, natural frequencies and mode shapes.
- **General Beam Analysis** - Employs finite element analysis of a general beam with multiple sections and supports to compute static displacements, rotations, shears, moments, stresses, natural frequencies and mode shapes.
- **Pressure Vessels** - Calculates the wall stresses and deflections in homogeneous, linear elastic, isotropic, cylinders and spheres subject to internal and/or external pressure.
- **Column Buckling** - Determines the critical axial compressive load and stress for long or short column buckling.
- **Hooke's Stress/Strain Calculation** - Applies Hooke's Law to calculate stresses/strains for a three-dimensional state of strain/stress within the linear elastic range. This module also calculates principal stresses and strains, and strain energy.
- **Contact Stresses** - Calculates stresses caused by contact between two isotropic elastic bodies such as a sphere on a plane, a sphere on a sphere, a cylinder on a cylinder, a cylinder on a plane, and similar curved surfaces.
- **Compression Spring Design** - Computes spring design parameters for close-coiled round wire helical compression springs, including spring rate, maximum force, maximum displacement, and maximum shear stress.
- **Interference Fit** - Evaluates the contact pressure between two isotropic elastic cylindrical parts subject to an interference fit. The module also calculates the change in radii of the members, tangential stresses, and maximum torque that can be transmitted by the interference.

Dynamics and Controls Library

- **Spring-Mass System** - Calculates the natural frequencies, mode shapes, and steady-state harmonic response of a generic system of n discrete springs, dampers, and masses.
- **Arbitrary System Dynamic Response** - Creates a dynamic simulation of linear and nonlinear systems using a fourth-order Runge-Kutta numerical integration algorithm.
- **Linear System Time Response** - Uses classical closed-form equations to calculate the time response of linear dynamic systems to user-specified initial conditions and forcing functions.
- **Bode Plot** - Creates a Bode Plot for dynamic systems whose transfer function is expressed as the ratio of numerator and denominator polynomials.
- **Uniform Beam Frequencies** - Uses closed-form equations to calculate the natural frequencies and mode shapes of a single-span uniform beam with various boundary conditions.
- **Dynamic System Animation** - Creates animations of an arbitrary dynamic systems.

Fatigue And Fracture Mechanics Library

- **Singular Stress and Displacement Fields** - Determines the stresses and displacements at a point near a crack tip.
- **Miner's Rule** - Calculates the fatigue life of a part under variable amplitude loading using constant amplitude fatigue life data.
- **Fatigue Crack Growth** - Computes the fatigue crack growth rate and the cycles-to-failure assuming a Safe-Life design approach.
- **Plastic Zone Size** - Solves for the radius of the region of plastic strain near a crack tip.
- **Strain-Life Fatigue Analysis** - Calculates the fatigue life of a part under constant amplitude oscillatory loading assuming that the strain range controls fatigue life.
- **Stress-Life Fatigue Analysis** - Determines the fatigue life estimate of a part under constant amplitude oscillatory loading assuming that the stress range controls fatigue life.
- **Stress Concentration Factors** - Calculates stress concentration factors and stresses for various shaft and plate geometries assuming homogeneous, isotropic, and elastic material.
- **Stress Intensity Factors** - Computes the stress intensity factors for through-cracks in flat plates subject to Mode I (normal to the crack plane), Mode II (in-plane shear loading), and Mode III (out-of-plane shear loading) loading. This module can also calculate the residual stress, the maximum permissible crack length, the fracture toughness, the critical stress for a given crack length, and the critical crack length for a given stress.

Numerical Methods Library

- **2-D Function Plotter** - Creates two-dimensional line plots of user-defined mathematical expressions of the form $y = f(x)$.
- **Matrix Operations** - Solves a number of common problems in computational linear algebra, such as matrix arithmetic, matrix inversion, determinants, eigenvalues and eigenvectors, dot products, cross products, and more.
- **Polynomial Roots Solver** - Computes the roots of a polynomial with real coefficients. The roots can be real or complex numbers.

Reference Utilities Library

- **Beam Section Properties** - Calculates geometric section properties for general cross section types and provides section properties for standard steel and aluminum sections. Computed section properties can be automatically transferred as input data to other ETBX modules.
- **Material Properties** - Provides a reference database of material properties that can be automatically transferred as input data to other ETBX modules.
- **Unit Conversions** - Converts units of a selected physical quantity from the selected input unit to the selected output unit.
- **Solid Properties** - Calculates the mass properties of common homogeneous solids.



PO Box 14596
Arlington, TX 76094
866.364.7277
www.engrasp.com