The torsional vibration package uses a finite-element based formulation for performing damped and undamped torsional natural frequencies, mode shapes, stability, steady-state response, and time-transient response of mechanical drive trains. **TORSION** consists of three sub-modules: **TORNAT**, **TORHRM** and **TORRSP** integrated by **TORSION**'s module messenger. The messenger controls the sub-modules to provide a complete torsional vibration analysis environment.

The release of RBTS' ARMD Version 6 Torsion is a major milestone in the product's development history, rolling out a completely new and improved graphical user interface for the package with enhanced numerical capabilities and features. The software's front end was redesigned with our customers' and industry's input to incorporate the most logical, efficient, and productive techniques to model and analyze complex multi-shaft systems for torsional vibrations.

**ARMD TORSION** users will immediately see the improvements as element, shaft, and system data are presented in a flatter format, with key fields and analysis options readily visible and accessible from the main data entry screens. Engineering productivity to design models is vastly improved as shafts and systems can be easily imported from user-generated component template models. Furthermore, the ability to simultaneously run multiple instances of the program permits rapid side-by-side comparison of results.
By identifying new trends from industry standards, along with RBTS’ involvement in turbomachinery standards revisions, new technical features were added to the software. Addition of equivalent torsional stiffness diameters, better handling of shaft connections, expanded user-defined torques application, and access to temperature dependent properties all combine to provide more accurate modeling and matching of analysis results to actual system empirical results.

TORSION accepts/imports models generated with the rotor dynamics package “ROTLAT” and has advanced modeling features and capabilities including the modeling of multi-shaft/multi-branch systems, coupling stiffness and damping, gear tooth flexibility, stiffness/mass/inertia diameter, torsional springs to ground, various types of external excitations, synchronous motor start-up torque, compressor load torque, user specified time varying torques, electrical faults for motor and generator, and many others.

Among the features incorporated in TORSION package are electrically-induced, time-varying exciting torques associated with generator and induction motor operation that include:

**Generator**
1: 3-phase short circuit
2: Line-to-line short circuit
3: False coupling short circuit

**Induction Motor**
4: Start from standstill
5: 3-phase short circuit at terminals
6: 2-phase short circuit at terminals
7: High-speed automatic reclosing

**Equation Type 3, Generator, False coupling short circuit**

\[ T_e(t) = -t_{rot} \left[ A + B e^{at} + (C \sin(2\pi ft) + D \cos(2\pi ft) \cdot e^{af}) \right] \]

**Coefficients**
- \( A = 0.0235 \)
- \( B = 5.083 \)
- \( a = -17.033 \)
- \( C = 5.045 \)
- \( D = -3.119 \)
- \( f = -10.792 \)

**Electric Motor**

**Bull Gear**

**Fundamental Torsional Twist Mode**

**High Speed Pinion-Compressor**

**Electric Motor**

**Graphical User Interface**

**System Response**

**False coupling short circuit**
TORSION results include:

**NATURAL FREQUENCY**
- Damped and undamped
- Growth factors and damping ratios
- Vibration mode shapes
- Critical speed map (Campbell Diagrams)

**STEADY STATE RESPONSE**
- Vibratory amplitudes (displacement, velocity and acceleration)
- Dynamic torques
- Dynamic stresses
- Dynamic heat dissipation

**TIME-TRANSIENT RESPONSE**
- Dynamic shaft-torque time-history
- Dynamic stresses
- Fatigue life

Real-time graphics update of the 2-D image corresponding to numeric data input in data grids provides visual confirmation of model correctness while building system models. 2-D Model auto resizing gives user the option to "fit-to-page" complete models or single branches. User can automatically view the model with the correct aspect ratio, thereby permitting rapid, visual model review.

Built-in graphics utilities permits customization of graphics output of all outputs including steady-state and time-transient results as shown. This includes legends, notations, horizontal and vertical markers, fonts, symbols, colors, etc. Graphics is easily exported to other applications for presentation and reporting purposes.
**Purchasing Options**

ARMD is constructed from various solution modules for rotating machinery/systems:

- Rotor Dynamics
- Fluid-Film Bearings
- Torsional Vibration
- Rolling-Element Bearings
- Lubricant Analysis

Tailored to suit your needs and budget. You may purchase any combination of programs/modules or all if you wish. Licensing is available as a single seat or multi-seat network configuration. With your purchase, the package includes software (CD or download), quick start manual, electronic user’s manual, technology transfer and training session (optional), updates, maintenance, and support.

**System Requirements**

Computer with Microsoft Windows 7, 8, 10 or higher (32 or 64 bit).

**Remember**, with RBTS, you get more than just the programs, you get the company with more than 50 years of experience in the areas of tribology and machinery dynamics.

For further information, please contact us.

**RBTS, Inc.**

Rotor Bearing Technology & Software
1041 West Bridge Street
Phoenixville, PA 19460
USA

**ARMD**

The Worldwide Leading Software For Rotating Machinery Analysis

**Advanced Rotating Machinery Dynamics**

ARMD is a well established software package used worldwide to perform complete rotating machinery dynamic analysis. ARMD employs a user-friendly interface and window environment and context-sensitive help. ARMD integrates the most advanced and complete rotor dynamics, torsional vibration, and bearing analysis programs under one environment in a seamless fashion to give you the power to model your rotating machinery with ease, efficiency, and above all accuracy. Some applications in which ARMD has been utilized include rotating machinery such as a miniature air turbine for a dental drill, a large turbine generator set for a power plant, a small compressor for an air conditioner, a pump for an artificial heart, a fuel pump for a jet engine, an electric motor and spindle for a miniature computer hard disk, a canned pump for petrochemical processing plant, synchronous motor driven drive-trains, and gear boxes for a uranium enrichment plant and ship propulsion drives to name a few.

RBTS' software has gained international reputation for its:

- Technical Capabilities
- User Friendliness
- Completeness
- Support & Service

Please contact **Dr. Andreas Laschet** as the German & European consultant and representation with the following communication details:

Laschet Consulting GmbH · Friedrich-Ebert-Str. 75 · 51429 Bergisch Gladbach · GERMANY
Phone: +49 2204 84-2630 · E-mail: info@laschet.com · Web: www.laschet.com