



RecurDyn/2010  
Product & Services  
Catalog



# Advanced Engineering Solutions

## Innovative and future oriented technology

RecurDyn is an **innovative** Multibody Dynamics based CAE-software offering state-of-the-art MBD capabilities with an integrated powerful and unique non-linear FEM extension. RecurDyn's true **FEMBD** mechanical system simulation returns more precise dynamic motion results including stress analysis in one single simulation step. It also features flexible body contacts and non-linear deformations.

RecurDyn/CoLink, an integrated signal flow oriented control design tool, opens the door to an off-line simulation of mechatronic systems, going far beyond the classical Co-Simulation approach. By using a detailed RecurDyn FEMBD plant model the user can significantly reduce the number of loops during the virtual controller parameter optimization process.

The unique *Recursive Dynamics* solver technology represents one of the most efficient ways in solving MBD equation of motions today, providing high-rated solver robustness and reliability at the same time. All this **future oriented** technology is embedded in a modern GUI with a clear focus on "intuition", following standard software handling rules.

## Scalable, adaptive and application oriented

RecurDyn's **scalable** structure allows a step-by-step approach by starting from classical MBD methods, but never leads into a dead-end road if it comes to even non-linear FEA and control structure model refinements.

RecurDyn/ProcessNet lets the user **adapt** and integrate FEMBD capabilities to any CAE-process. By using C# the user has access to the full power of a standardized programming language not being trapped by the restrictions of a proprietary language.

Various **application oriented** libraries focus exactly on the specific simulation tasks of the customers.

## World class service and support

It is a saying in the CAE community that a software is only as good as the **support** behind it. This is even more true as software functionality and model complexity is steadily increasing. Only an experienced team which is also involved in real world consulting projects can offer a **world class service** the customer is paying for.

- First-rated interactive and parametric modeling environment providing CAD-like subsystem techniques. Supports all common CAD-data exchange formats.
- Complete state-of-the-art Multibody Dynamics component library.
- Advanced general 3D-contacts including analytical contacts for a wide range of regular shapes.
- Part flexibility using modal reduction or unique non-linear FE-structures including contact analysis and large deformations.
- Supports multidisciplinary models with the integrated control design package RD/CoLink or via open Co-Simulation interface (e.g. MATLAB/Simulink, Amesim)
- Latest solver generation with robust and reliable IMGALPHA single-step and DASSL multi-step methods, featuring unique Hybrid-Solution technology for large models.

- Due to a modular concept RecurDyn can grow parallel to the user's experience and functional software demands.
- RD/ProcessNet, a professional C# based application programming interface (API), lets any user automate, adapt and extend RecurDyn functionality to his specific needs.
- Application oriented toolkits feature professional build-in know-how from industrial development partners.

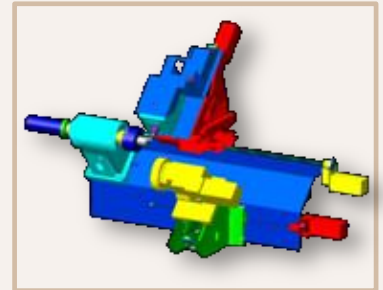
- FunctionBay offers professional services in all areas of mechanical simulation.
- The RecurDyn hotline is served by experienced consulting engineers to guarantee high level customer satisfaction.

### RecurDyn/Professional

**Integrated multidiscipline mechanical system simulation.** Foundation module, embedding all other interdisciplinary toolkits and vertical applications. Includes RD pre- and post-processor and RD/Solver.

**Complete MBD functionality.** RD/Professional features a state-of-the-art library of MBD elements (rigid bodies, constraints, forces ...), with a specialization in powerful 3D-contact simulation.

**CAD like modeling.** RecurDyn/Professional has a build in CAD-kernel based on Parasolid from Siemens PLM, allowing the user to create and modify geometry like in a CAD system. RecurDyn supports geometry data exchange via Parasolid, ACIS, CATIA, STEP and IGES.

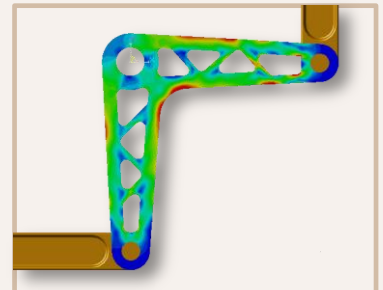


### RecurDyn/RFLEX

**Flexible bodies based on modal reduction.** Adding flexible bodies can significantly improve the result quality by a more precise prediction of the dynamic response and the load transfer through the structures due to component compliances.

**Craig-Bampton method.** RD/RFLEX uses the Craig-Bampton method if the flexible bodies are directly generated from ANSYS or NASTRAN by an automatic procedure. The interface also allows an augmentation of individual mode shapes, which may be added to improve the solution.

**Stress analysis included.** RD/RFLEX calculates stresses as a standard post-processing procedure which can be used for durability predictions.

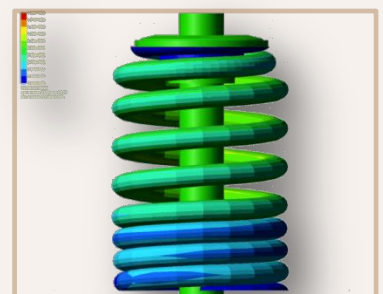


### RecurDyn/FFLEX

**FEMBD at its best.** RD/FFLEX lets the user simulate non-linear FEA structures within a system level analysis. It uses the full set of degrees of freedom of a flexible body during the simulation allowing an update of the stiffness and mass matrices whenever necessary.

**Extending virtual prototyping capabilities.** This true FEM and MBD coupling overcomes the restrictions of the modal reduction technique if it comes to local contact analysis and non-linear deformations.

**Integrated solution.** RD/Solver is augmenting the MBD differential equations by the degrees of freedom of the RD/FFLEX body to solve for a combined solution at each time step including stress results.

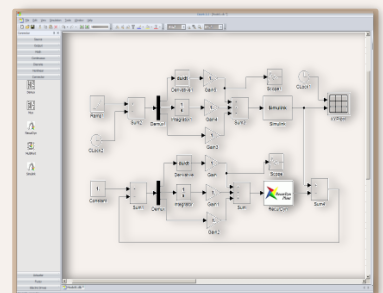


### RecurDyn/CoLink

**Mechatronic system level simulation.** RD/CoLink is a signal flow based simulation package with a block oriented user interface allowing control parameter optimization based on a high-level mechanical model.

**Rich control element library.** RD/CoLink features sources, math operations, non-linear objects and discrete respectively continuous elements. It also comprises fuzzy logic and a library of electric drives.

**Beyond Co-Simulation.** Besides Co-Simulation the control system can be fully embedded in RD/Solver by combining both systems to a single differential equation system. This significantly speeds up simulation time and takes back-coupling effects into account.





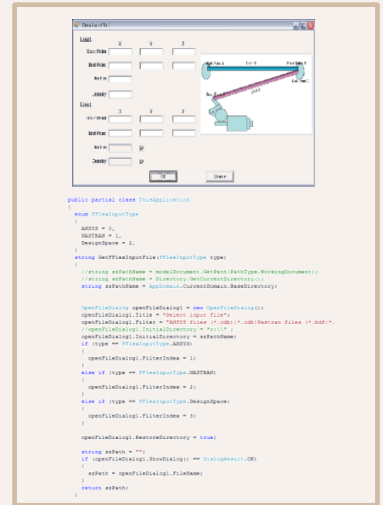
# Complementary Products

## RecurDyn/ProcessNet

**Process integration and automation.** RD/ProcessNet lets the user seamlessly integrate RD/FEMBD functionality into the CAE-design process of a company. A RD/ProcessNet algorithm could be a sophisticated program with several thousands lines or just a short macro to automate repeated tasks and increase efficiency.

**Professional development environment.** The RD/ProcessNet API is based on Microsoft Visual Studio for Applications. This professional development environment comprises object oriented programming combined with comprehensive debugging and powerful GUI design capabilities.

**Benefit from a large user community.** The RD/ProcessNet user can participate from user groups and publicly available information by downloading utility routines and example code from the internet, a clear advantage in using a programming standard and not a propriety command language.



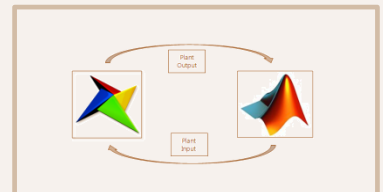
## RecurDyn/Linear

**Eigenvalue solver.** RD/Linear calculates undamped and damped eigenvalues and eigenfrequencies of a mechanical system. RD/Linear supports combined Multibody Dynamics and RD/RFLEX degrees of freedom.



## RecurDyn/Controls

**Co-Simulation interface.** RD/Controls features a Co-Simulation interface to MATLAB/Simulink<sup>®</sup> from The Mathworks or to any other 3<sup>rd</sup> party program (e.g. in-house software) with a user defined fixed sampling time.



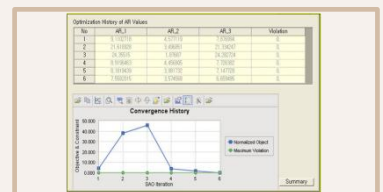
## RecurDyn/Hydraulics

**RD/Hydraulic interface.** The RD/Hydraulic interface is a particular deployment of the general RD/Controls interface. It allows Co-Simulation with the hydraulic software AMESim<sup>®</sup> with a user defined fixed communication interval.



## RecurDyn/AutoDesign

**Parameter optimization.** RD/AutoDesign provides Sensitivity Studies, Design Optimization and DFSS/Robust Design Optimization capabilities with multidiscipline design parameters also including controller parameters from RD/CoLink.



## RecurDyn/Tire

**Tire interface to RecurDyn.** RD/Tire comprises multiple types of standard tires models for either vehicle handling analysis, ride and comfort, or durability analysis. RD/SoilTire features a tire model for flat and uneven soft ground for off-road vehicles.





## RecurDyn Toolkits

### Drive Components

#### RecurDyn/Chain

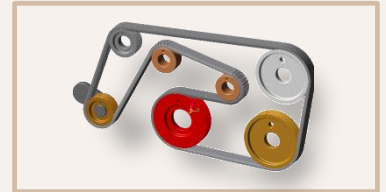
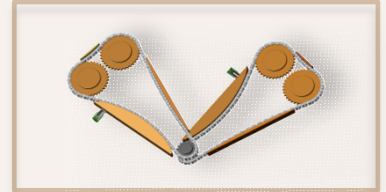
**Timing and conveyor chain analysis.** RecurDyn/Chain comprises a predefined library of chain drive components like sprockets, tensioners and guide elements. It allows the analysis of internal forces respectively the lateral and longitudinal vibrations for NVH and durability studies.

#### RecurDyn/Belt

**Belt drive system analysis.** RD/Belt supports belt drive components like pulleys and roller elements for flat, timing and (poly-) V belt types. Simulation results are reaction forces and rotational vibrations, belt tension, and longitudinal and lateral oscillations for NVH studies.

#### RecurDyn/Gear

**Gear drive and transmission analysis.** RD/Gear supports spur, helical, bevel and worm gears. Teeth geometry can be defined by standardized gearing parameters or by a freely user defined tooth profile. RD/Gear is used for backlash studies and gear shaft rotational vibration analysis.



### Vertical Applications

#### RecurDyn/Engine

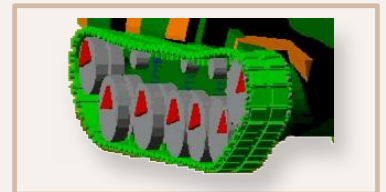
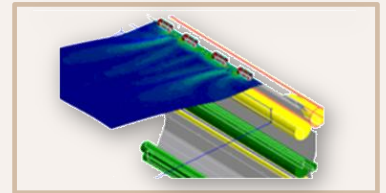
**Power train simulation.** RD/Engine is a comprehensive suite of power train simulation products, comprising RD/CrankTrain, RD/ValveTrain and RD/TimingMechanism. All toolkits can be used stand alone or in combination to perform a complete engine simulation.

#### RecurDyn/MTT

**Media transportation analysis.** RD/MTT is a special purpose toolkit for the simulation of thin media (paper, foil,...) through media handling machines like copy machines, printers and ATMs. The RD/MTT library comprises guides, roller pairs and a 2D/3D sheet media representation.

#### RecurDyn/HMT/LMT

**Tracked Vehicles Analysis.** RD/HMT/LMT is a special purpose toolkit for the simulation of high mobility respectively low mobility tracked vehicles. Its component library features different types of track link elements, sprockets, rollers, a soft ground representation and more.

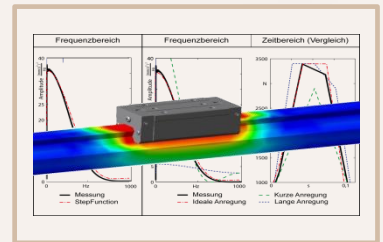
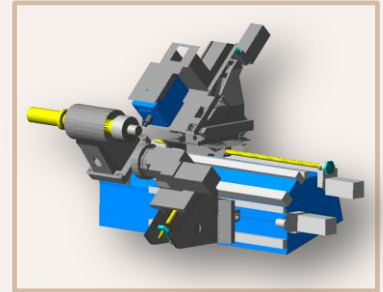


### Vertical Applications

#### RecurDyn/Machine Tool

**Machine Tool simulation.** To steadily stay ahead of competition, machine tool manufacturers are currently forced to perform a paradigm change from conservative developing and testing methods towards the utilization of Computer-Aided-Engineering (CAE) software. In order to facilitate the access to Virtual Prototyping (VP) software tools, FunctionBay, the Technical University of Munich (IWB) and the MT manufacturer FRAMAG have commonly developed a dedicated simulation software which totally focuses on the requirements of the machine tool manufacturing branch.

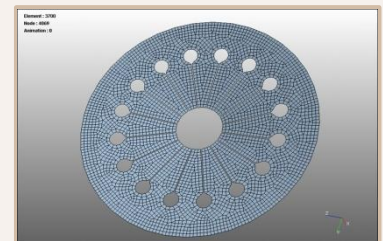
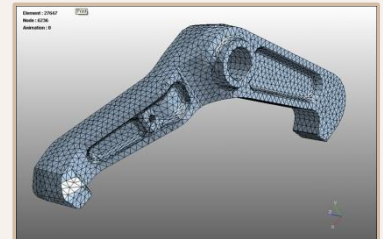
**Component libraries.** RecurDyn/MT components can be modeled with different levels of detail to focus on specific aspects of the machine simulation. It comprises ball screw motion drives and linear guides, bearings etc. which allow large motion analysis of full flexible structures. The necessary data to fill the parametric models can be extracted from supplier catalog data sheets. RecurDyn/MT also provides tools to run standardized maneuvers like ISO circularity tests and others.



#### RecurDyn/Mesher

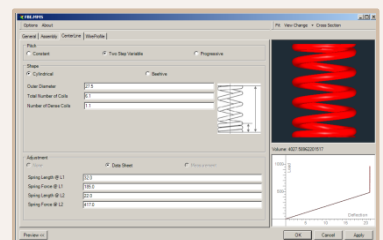
**Fully integrated mesh engine.** From Version 7 R5 RecurDyn offers a fully integrated mesh engine to directly support RecurDyn/FFLEX and also RecurDyn/RFLEX in the near future. RecurDyn/Mesher closes the last open gap in the process chain of the RecurDyn Multi-Flexible Body Dynamics technology. Complex system level simulations including component elasticity can now be build-up and performed completely inside RecurDyn without the need for an external FE program.

To finally complete the integration of MBD and FEA in RecurDyn the level of compliance (Rigid, RFLEX or FFLEX) will be just a user switchable property of a generic body, breaking up the traditional distinction between Rigid Bodies and Flexible Bodies as still being utilized in conventional MBD software. In the first version the auto-mesher supports solid and shell element meshes. It also comes with a build-in logic to analyze and efficiently model the connectivity areas between flexible and rigid structures in the model.



#### RecurDyn/CompressionSpring

**Detailed spring analysis.** RecurDyn/CompressionSpring allows a detailed analysis of the internal spring dynamics. The user can select between a highly efficient Multi-Mass-Spring model taking only the axial spring dynamics into account or a complex RD/FFLEX approach featuring also effects like transverse coil motion. It also includes stress results based on the dynamic loading in order to analyze and predict the springs durability performance.





### FunctionBay (FBG) - Company Mission

Realities have proven that increasing time-to-market demands together with concurrent product reliability and performance requirements are competitive aspects of today's product development processes which can only be tackled by an extended software prototyping utilization. The mission of the FBG/Professional Engineering & Services Team is to assist our customers in achieving those goals by successfully deploying state-of-the-art CAE simulation software tools.

### Supplying Advanced Engineering Values

CAE software is not the solution itself but can be regarded as a necessary tool to address demanding engineering development tasks. The FBG Engineering & Service Team is committed to leverage the CAE software utilization by providing augmenting professional add-on services to our customers.

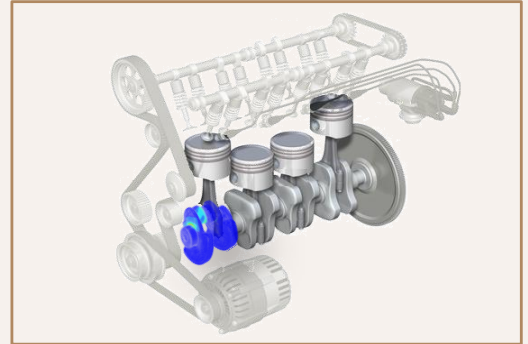
Our surplus values for our customers are going far beyond the classical CAE-model creation as a part of an "isolated" consulting project; we also assist our customers in the global planning and set-up process of a simulation matrix to efficiently perform the right simulations needed to safeguard product design concepts and to activate possible product optimization capabilities. Within our services we offer a target-oriented training of your engineers to transfer our simulation know-how and we coach them in how to most efficiently deploy best-practice simulation methods in your specific application areas.

Producing reliable simulation results is only one step in taking the full advantage of virtual prototyping tools. Our consulting engineers are closing the developing loop by supporting you in the result interpretation and discussing with your engineers how to hereof derive necessary design decisions for your product design.

### Committed to Excellence

As an engineering solution provider committed to excellence, our FunctionBay consulting engineers will successfully activate and exploit the full potential of virtual prototyping tools in your company, justifying the efforts and costs of such simulation environments.

## Advanced Engineering Solutions



FBG's Professional Engineering Team offers the following services:

- Consulting projects and analysis services for fully integrated multi-discipline CAE - simulations
- Planning, continuous monitoring and optimization of CAE software introduction processes
- Customized seminars including "training-on-the-job" workshops
- Process capture and automation of repetitive simulation tasks (software customization)
- Development, deployment and coaching of best practices for customer specific applications
- Onsite engineering to augment customers staff for "hot-projects"
- Complete product design support including full scale engineering service and know-how transfer to our customers

- First rated consulting partner of the German automotive and general machinery industry
- Long term CAE software application experience in all kinds of industries

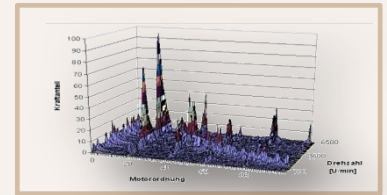
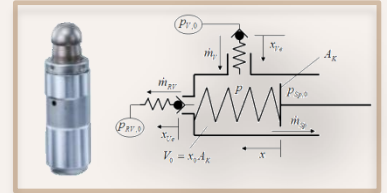


## Advanced Engineering Experiences

FBG/Professional Engineering offers consulting services backed by over 20 years of experience in Multi-Body Dynamics, Finite Element Analysis and Controls. Our service team includes a hundreds of man-years of application experience in the fields of CAE simulation.

FBG's industrial experience comprises Automotive (Power-Train and Chassis), Machinery, Packaging, Electronics, Machine Tools, Biomechanics and other applications.

## Advanced Engineering Solutions



FunctionBay GmbH · Infanteriestraße 19 | House 3 · D - 80797 Munich  
+49 (0)89/322098-0 · info@RecurDyn.de · <http://www.FunctionBay.de>

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