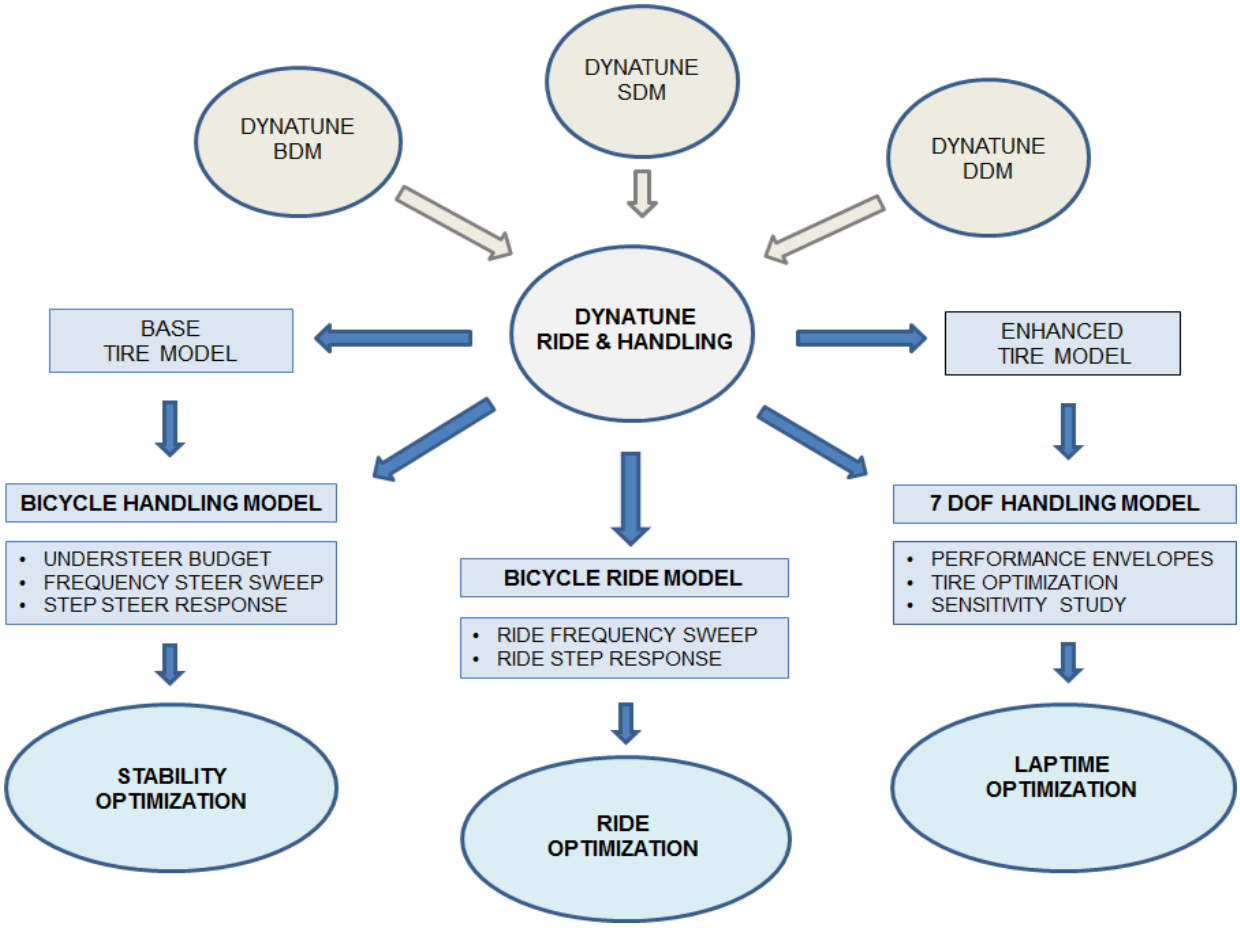
DYNATUNE-XL SIMULATION TOOL SUITE

SOFTWARE TOOLS FOR SUSPENSION DESIGN, RIDE & HANDLING, ACCELERATING & BRAKING USING MS EXCEL ® INTERFACE.

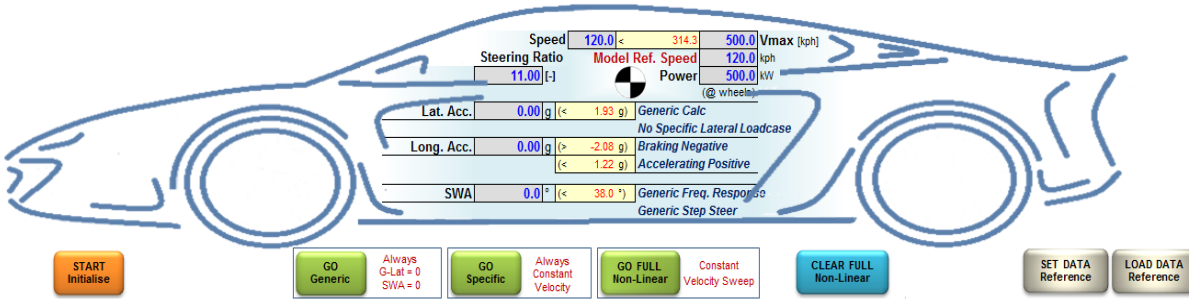
DYNATUNE-XL is the registered name of a suite of core skill **MS EXCEL** ® based Engineering and Simulation Tools.

The **DYNATUNE-XL** Tool Suite does provide Professional Engineering Tools covering the most Important Aspects of Vehicle Dynamics. All Tools aim to achieve a Maximum of Results with a Minimum of Input Data allowing quick Setup Checks or - if wanted - more complex Generic Parameter Studies. Being a fully **MS EXCEL** ® based Tool does significantly reduce the application threshold for many engineers and technicians. MS Excel is available on most computers as part of **MS OFFICE** ® and widely supported in business applications**.**

Our Suite of Tools does exist out of the following (standalone) Modules:



DYNATUNE-XL – RIDE & HANDLING MODULE



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The **DYNATUNE-XL RIDE & HANDLING MODULE** has been specifically developed & validated over the last 30 years around the equations of a Bicycle Model & a 7-DOF Vehicle Model and is entirely focused on providing an efficient tool for optimizing the basic **RIDE & HANDLING** behaviour of a vehicle. Two levels of complexity (Expert & Race) do allow clients to select the best suited variant for their specific needs and/or knowledge status.

The Analytical Features have been developed to cover all disciplines of Vehicle Dynamics and are perfectly suited to cover all aspects from an upfront Concept Design Trade-Off Tool up to a typical Race/Development Engineers Setup at the (test-) track.

Various features can only be found in hugely complex expensive multi-body vehicle dynamics simulation tools. Finally, the included Performance Envelope Calculation and Laptime Simulation do underline the all-round-ness and inherent potential of this tool.

Vehicle Input Characteristics:

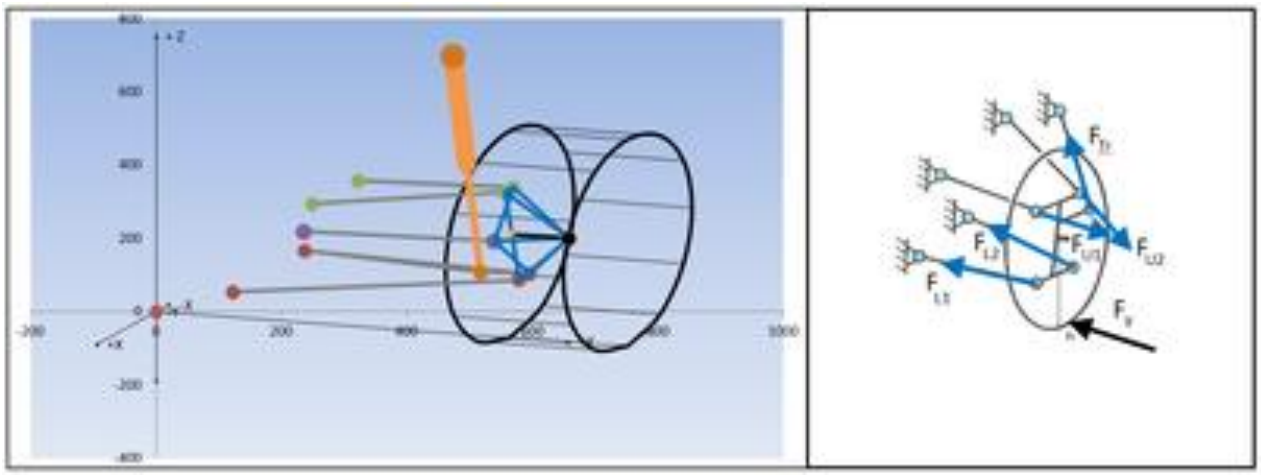
- Vehicle Mass, Passenger & Load (incl. Inertia)
- Vehicle Aerodynamics (can be Ride Height Dependant)
- Brake Distribution & Axle Drive Concept (FWD, RWD & AWD)
- Spring, Rollbar & Damper Settings
- Suspension Kinematic Table
- Suspension Compliance Table
- Custom Linear or Non-Linear Tire Model
- Generic Tire Data Base and Kinematic & Compliance Data Base Available

Simulation Features:

- Constant Velocity Lateral Sweep – Non-Linear
- Constant Radius Lateral Sweep – Non-Linear
- Frequency Steer Response Test – Linear & Partially Non-Linear w/ Load Transfer
- Step Steer Test – Linear & Partially Non-Linear w/ Load Transfer
- Body & Wheel Natural Frequencies & Damping Ratio Analysis
- Ride Bounce & Pitch Centre Analysis
- Ride Step & Frequency Response Test - Linear
- Limited Slip Differentials, Full Torque Vectoring Analysis & Yaw Moment Calculation
- Full Performance Envelope Calculation
- Regenerative Powertrain Braking
- Laptime Simulation with 20 Parameter Laptime Sensitivity Study Analysis (DOE)

The **DYNATUNE-XL R&H MODULE** has been used at the "cradle" of many important & iconic cars, is well established in the Automotive OEM World and is used by many Professionals & Vehicle Dynamics Enthusiasts all over the world.

DYNATUNE-XL – SUSPENSION DESIGN MODULE



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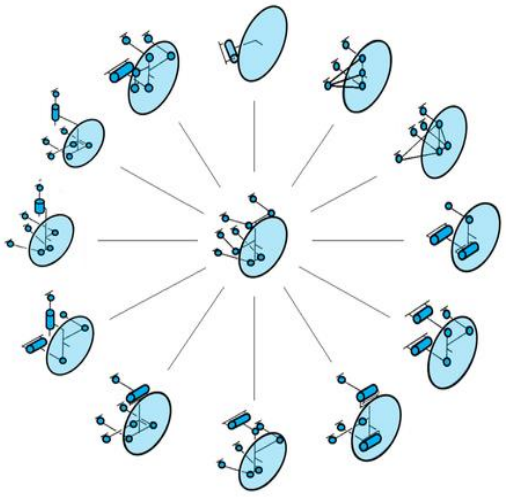
The **DYNATUNE-XL SUSPENSION DESIGN MODULE** does provide with its unique vector algebraic approach the possibility to model and analyse the geometry and (steering) kinematics of almost any kind of Independent Front & Rear Suspension Type, including even the most complex Multi - Link Suspension architectures.



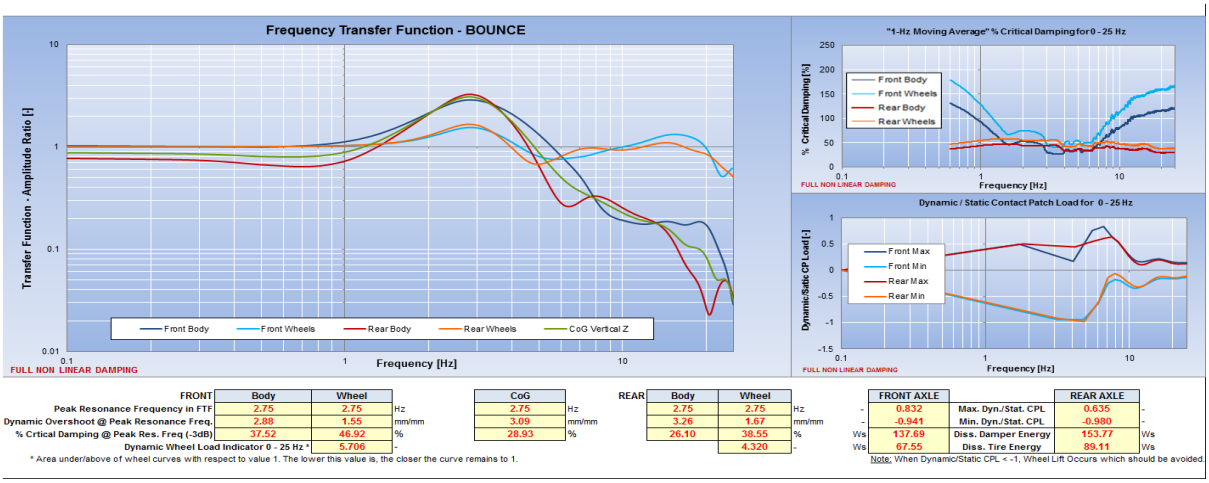
DYNATUNE-XL SDM provides in the Expert Version also - quite uniquely and not offered by any of its peer competitor tools - the ability to analyse elementary compliant suspension behaviour, either by providing a reference metrics table or by displaying the results of (combined) contact patch force induced suspension Link Loads & Deflections.

In it's latest **RELEASE 8.1** the Expert Version of **DYNATUNE-XL SDM** does come with a a truly Unique Elasto-Kinematic Optimizer allowing the User to generate quasi in Full Automatic Mode the best matching Suspension Geometry and Compliant Requirements to match the imposed Targets and Constraints

STEP 1 MANDATORY PREPARE OPTIMIZATION EVENT & LOAD SUSPENSION DATA FROM MASTER DASHBOARD	STEP 2 RUN SENSITIVITY ANALYSIS	STEP 3 START / RESET OPTIMIZATION	STEP 4 CONTINUE / RUN OPTIMIZATION	STEP 5 SET OPTIMIZED DATA AS NEW STARTING POINT	STEP 6 COPY NEW / OPTIMIZED DATA TO MASTER DASHBOARD	RESET ALL SUSPENSION DATA BACK TO ORIGINAL "STEP 1" LOADING CONDITION
		RUN FULLY AUTOMATIC STEP 3, STEP 4 & STEP 5 OPTIMIZATION LOOP				
	EXECUTE FULL AUTOMATIC SENSITIVY ANALYSIS & OPTIMIZATION LOOP (s) WITH FINAL VERIFICATION RUN				6 Number of Full Optimization Loops	

DYNATUNE-XL SDM is considered by many customers in the professional automotive world to be the Best-In-Class Suspension Kinematic Analysis Tool. Due to its unique versatility the tool is also highly appreciated by the many (club-) racers who design & build their own cars.

DYNATUNE-XL – SUSPENSION TUNING MODULE



FRONT	Body	Wheel		CoG		REAR	Body	Wheel		FRONT AXLE		REAR AXLE	
Peak Resonance Frequency in FTF	2.75	2.75	Hz	2.75	Hz		2.75	2.75	Hz	0.832	Max. Dyn./Stat. CPL	0.635	-
Dynamic Overshoot @ Peak Resonance Freq.	2.88	1.55	mm/mm	3.09	mm/mm		3.26	1.67	mm/mm	-0.941	Min. Dyn./Stat. CPL	-0.980	-
% Crtical Damping @ Peak Res. Freq (-3dB)	37.52	46.92	%	28.93	%		26.10	38.55	%	137.69	Diss. Damper Energy	153.77	Ws
Dynamic Wheel Load Indicator 0 - 25 Hz *		5.706	-					4.320	-	67.55	Diss. Tire Energy	89.11	Ws

* Area under/above of wheel curves with respect to value 1. The lower this value is, the closer the curve remains to 1.

Note: When Dynamic/Static CPL < -1, Wheel Lift Occurs which should be avoided.

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The **DYNATUNE-XL SUSPENSION TUNING MODULE** has been specially developed for those, who want to dive deep into the many complex vibrational aspects of suspension tuning. It is the perfect tool to analyse the often-complex interactions between springs and dampers.

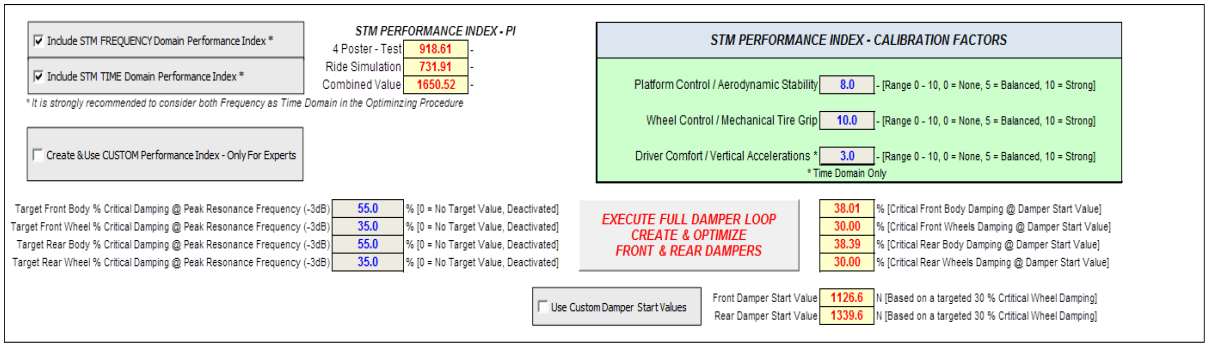
Next to the classical Damping Ratio and Bounce & Pitch Centre analysis the tool does offer to simulate dynamic events both in the Time Domain as in the Frequency Domain.

Typical Fully Dynamic Simulation Events are:

- Fully Dynamic Ride Step – Time Domain, Fully Non-Linear Damper
- Fully Dynamic Ride HavSin – Time Domain, Fully Non-Linear Damper
- Fully Dynamic Ride Frequency Response Test - Linear Decaying Amplitude
- Fully Dynamic Ride Frequency Response Test - Exponential Decaying Amplitude

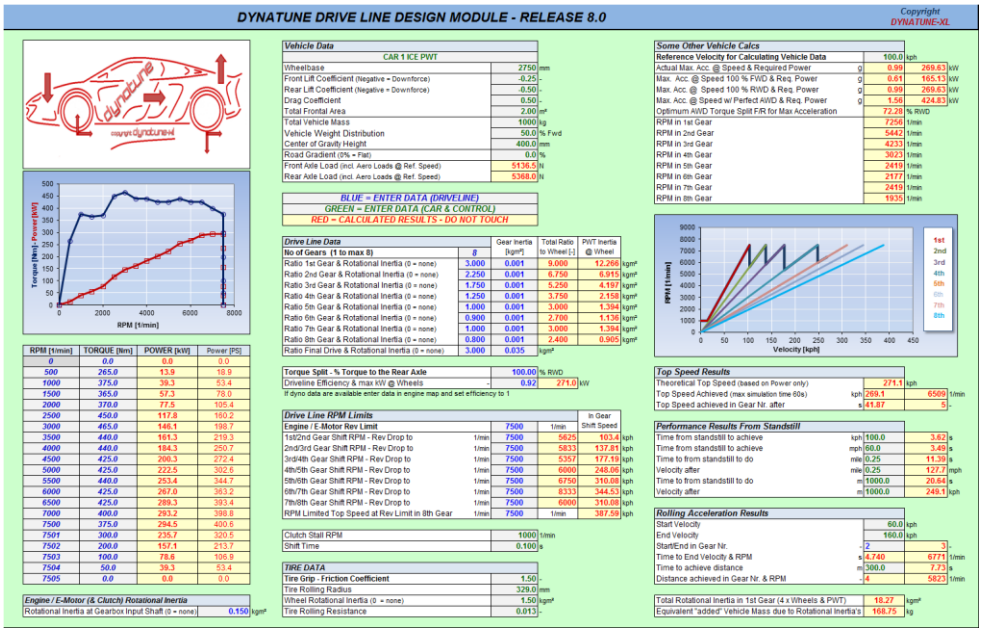
All of the above events can by fully parametrized to specific test requirements. A full range of Key Performance Indicators will be calculated allowing objective comparisons of various setups.

On top of that **DYNATUNE STM** does also offer the truly Unique Feature to Optimize Damper Settings Automatically towards a range of customer defined Targets and/or Cost Functions.



DYNATUNE-XL STM is a truly powerful standalone tool, which enables one to get the best out of one's ride setup by executing and analysing advanced 4-Poster Ride Setup Procedures combined with various Time Domain Ride Obstacles Event Simulations.

DYNATUNE-XL – DRIVE-LINE DESIGN MODULE



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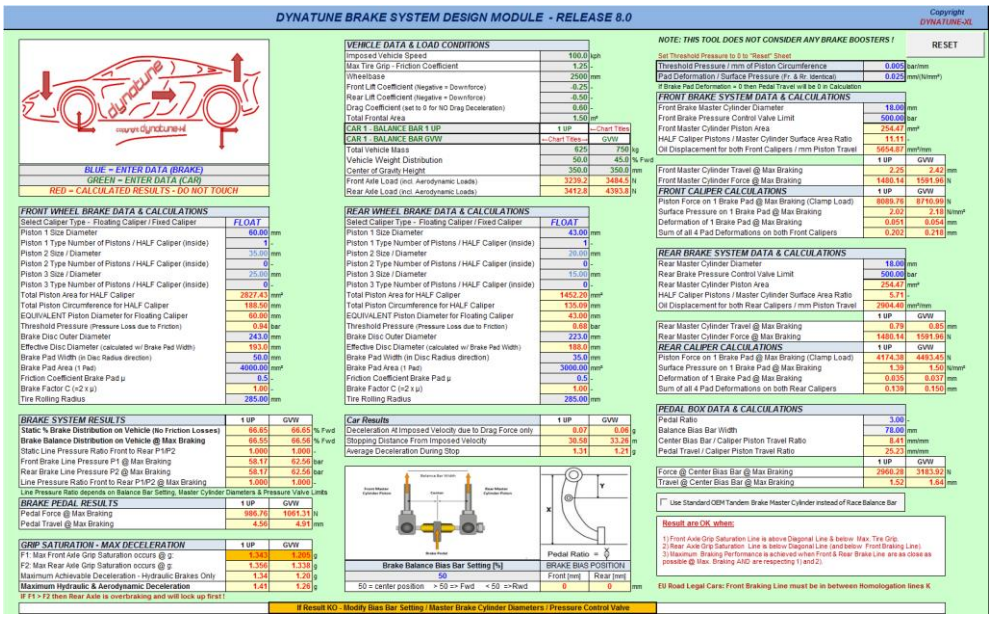
The **DYNATUNE-XL DRIVE-LINE DESIGN MODULE** does permit to optimize gearbox (up to 8 gears) and differential ratios and match the Drive-Line perfectly to the Engine Torque & Power Characteristics. It is a must have tool for straight forward straight-line performance analysis and is essential for any custom build gearbox gear ratio specifications.

Next to ICE Power Trains also Electrical Propulsion can be simulated and optimized. Powertrain and Rotational Inertia's of the 4 Wheels are fully considered.

DYNATUNE-XL – BRAKE- SYSTEM DESIGN MODULE



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The **DYNATUNE-XL BRAKE DESIGN MODULE** is indispensable if you are a club racer or you build/modify your own car. Our **DYNATUNE BDM** does allow one to design (or mix & match) brake hydraulic systems considering all parameters which do affect braking performance. One can define Piston & Rotor Diameters and select the best matching Brake Master Cylinder for optimal Brake Distribution and Pedal Travel.

Classical (OEM) Tandem Master Brake Cylinders or Racing Brake-Bias-Balance-Bars are available as base configurations. Aerodynamic Downforce & Drag Influence are also taken into consideration.

SOFTWARE REQUIREMENTS & LICENSE MANAGEMENT

Software requirements for **RELEASE 8.0** and onward are **Full** Versions (incl. latest updates) of **MS EXCEL ® 2010, 2013, 2016** or **2019** or **Office/365** with a **MS Windows ® XP, Windows Vista, Windows 7 Starter, Windows 7, Windows 8** or **10 Operating System**.

All Modules of **DYNATUNE-XL** come as a compiled executable (*.exe) binary file which will call **MS EXCEL®** as a separate stand-alone instance. Source code is copyright protected and safe data handling is guaranteed through secure binary files.

Standard Customer Licenses are typically valid for the use of the workbooks (and ALL user-saved variants) on 1 computer and for 1 user only without a timing constraint.

The protection software does offer to the customer next to the security of encoded binary data handling also - by means a unique License Key Verification Procedure - a state–of-the-art data protection.

License support is available for the latest releases only and as there is no annual maintenance fee existing clients with older product releases can acquire "upgrading" licenses to the latest version release at special client rates.

Recommended minimum hardware configuration for the **DYNATUNE-XL** Tools are Intel Core i5/i7 CPU (or similar) with 4GB Ram.

All Units in **DYNATUNE-XL** are SI.

DYNATUNE-XL DEMO VERSIONS

DEMO Versions of the following DYNATUNE-XL Modules can be downloaded here:

- DYNATUNE Ride & Handling Module: http://www.dynatune-xl.com/download-demo-rh.html
- DYNATUNE Suspension Design Module: http://www.dynatune-xl.com/download-demo-sdm.html
- DYNATUNE Suspension Tuning Module: http://www.dynatune-xl.com/download-demo-stm.html

DYNATUNE-XL STORE

B2C customers can acquire the various **DYNATUNE-XL** Modules online in our webstore:

http://www.dynatune-xl.com/store/c1/Featured_Products.html

B2B customers are kindly requested to contact us directly.

DYNATUNE-XL CONTACT

Website: www.dynatune-xl.com
Email: info@dynatune-xl.com