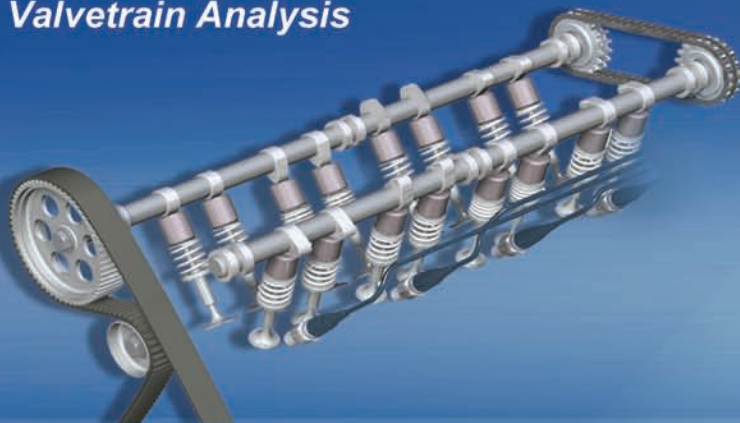




Highlights:

Models conventional and variable lift mechanisms

Multi-polynomial and B-spline valve lift curve synthesis (cam design)

Valvetrain kinematics

Quasi-static rigid analysis with inertias and springs

Valvetrain multi-body dynamics: rigid and flexible bodies

Higher-level, expert-system valvetrain toolbox (cam, valve, lifter, rocker, finger, pushrod, HLA) + general 2D/3D shapes

Visualization and animation of valvetrains

Single branch or complete multi-cylinder valvetrain

Camshaft torsional vibrations (time and frequency domain)

Camshaft bending and bearing oil films

Valvetrain Design Analysis

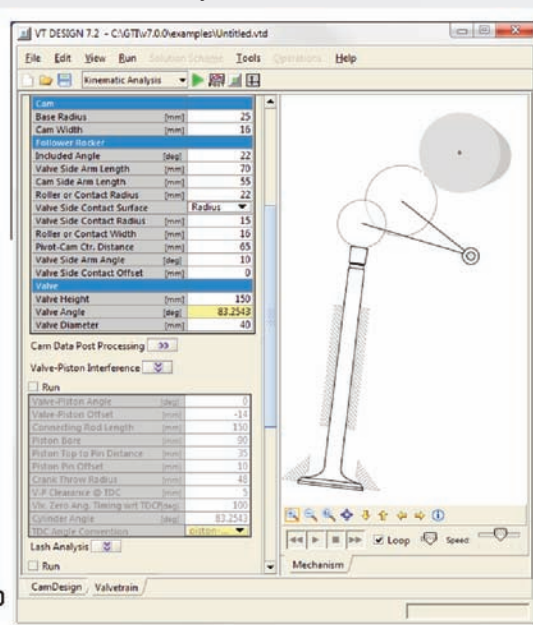
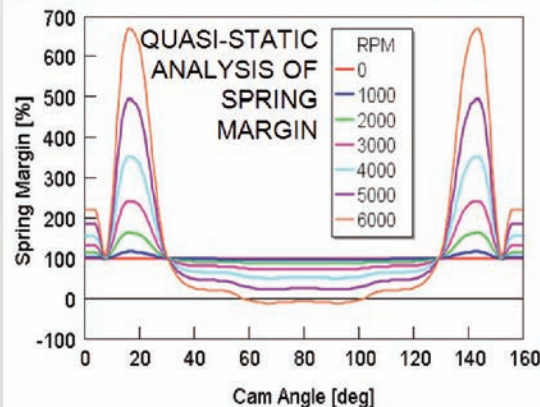
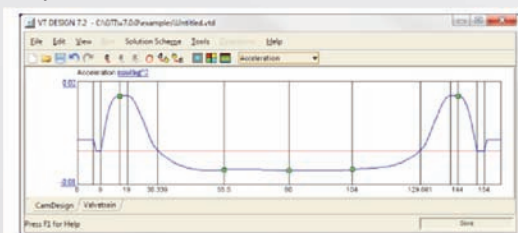
Valvetrain Dynamics and Kinematics, Cam Design

GT-SUITE features a complete set of tools for valvetrain engineering in a **single integrated environment**. Using these, engineers can focus on valvetrain design issues such as stability, durability and noise, as well as inherent tradeoffs between engine breathing and mechanical design objectives.

The GT-SUITE valvetrain analysis functionality is based primarily on three underlying general-purpose libraries:

- **General planar kinematics**
- **Multi-body Dynamics (MBD) : 1D/2D/3D/Flexible bodies**
- **Valvetrain component toolbox**

The valvetrain toolbox is a library of specialized “expert-system” valvetrain components built on top of MBD elements and with many ease-of-use and automation features. They are described in valvetrain engineering terms, and in simulations produce a large number of valvetrain engineering outputs and metrics. They can be mixed with basic MBD components to model unconventional or advanced valvetrain systems.



VTdesign GT-SUITE's user-friendly interactive facility for cam design, kinematic and quasi-static analysis is based on standard topologies and thier variations. It can be used for analysis of all common valvetrain types, without “building” models. VTdesign also creates a corresponding GT-SUITE MBD model with a single click.

Advanced Features and Applications:

Spring dynamics with distributed mass, stiffness and coil contact:

- Natural frequencies
- Surge, coil clash
- Contact, shear stress
- Spring fatigue analysis

Contact tribology: Hertz stress, deformation, oil film thickness, friction, at all contacts

Transition elements for mixed 2-D/3-D modeling

Hydraulic components: HLA, cam phaser, hydraulic valve actuation

Import reduced flexible body models from commercial FEA tools

Fully transient

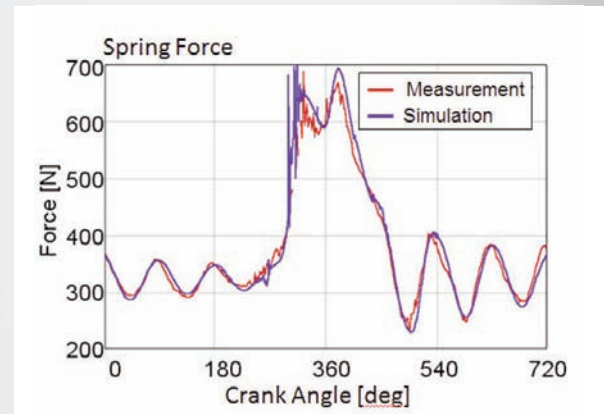
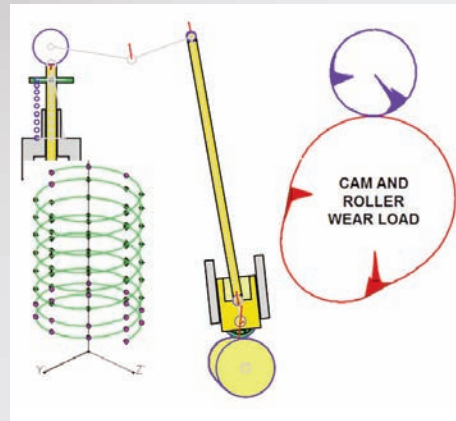
Fast runtimes due to choice of 6 ODE integrators

Seamless integration in GT-SUITE with:

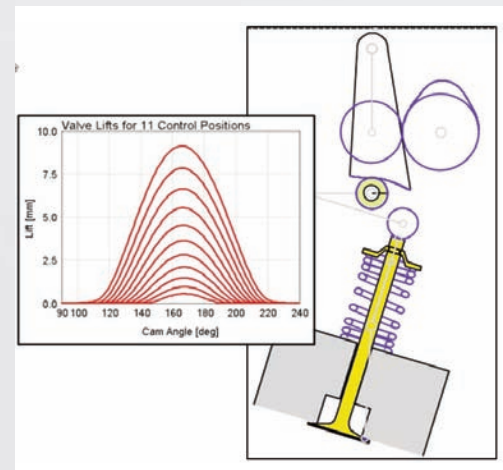
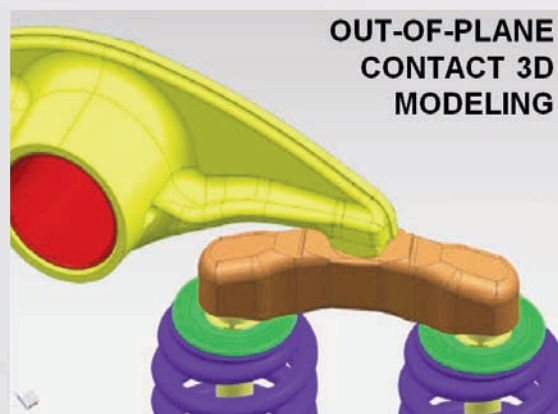
- Timing drives (eg chains)
- Cranktrain
- Lube system hydraulics
- Engine performance (GT-POWER)

These capabilities are included in every GT-SUITE license

Valvetrain MBD simulations produce output rich in information, including time plots of hundreds of quantities per valvetrain branch, in-depth durability-oriented predictions for springs and contacts, HLA transient pump-up/pump-down, valve overlap, valve-piston interference and spring margin metrics. Models can be visualized and dynamics of valvetrains can be animated.



GT-SUITE's **General Planar Kinematics** and **MBD libraries** extend the reach of GT-SUITE to mechanism synthesis/design and dynamic analysis of any VVA or other non-conventional mechanisms, including valvetrains with 3-D geometries, embedded HLAs, dual cams and others.



Models can be easily extended to cover **entire valvetrain systems** coupled to camshaft torsional or bending vibrations, thus enabling analysis of whole-system issues and variations/interactions between cylinders. Dynamics and **hydraulics of cam phasers** may be also included in such models.

