

## **Kinetics**

**Grasp the dynamic  
behavior of your systems**

## Perform multibody dynamic simulations and analyze the dynamics of your mechanical systems

The Kinetics tool, offers quick and accurate results in analyses that require the study of the dynamic behavior of mechanical systems. The tool is a member of the BETA CAE Systems Analysis tool-pack and is offered as an integrated solution within the ANSA pre-processor, providing several advantages through its robust and intuitive environment.

### Model set up

- Definition of multibody models using CAD or FE data.
- Several types of joint constraints to define connectivity between bodies.
- Impose friction directly on joints.
- Capability to impose motions on bodies and joints with or without including any initial conditions.
- Several types of forces with linear or nonlinear characteristics.
- Include custom user-defined forces that are described through Python scripts.
- Enhanced Expression Builder with an integrated parser to write non-linear expressions for entities.
- Simple step-by-step wizards for the definition of model entities.
- Available checks that identify and automatically fix modeling errors.

### Contacts

- Contact modeling based on smooth and non-smooth dynamics.
- Advanced friction modeling using Planar or Spatial isotropic friction types.
- Inclusion of the Stribeck effect for more realistic friction behavior.
- Configurable collision detection engine for increased accuracy and performance.

### Flex Bodies

- Instantly convert rigid bodies to flexible for more realistic behavior.
- Produce modal reduced files on the fly through the Flex Builder wizard without the need to setup an eigenmodes analysis from scratch.
- Explore and edit modal reduced files through the Flex Tools interface.

### Simulator

- Run kinematic and dynamic simulation in the time domain.
- Support of the implicit HHT time integration method.
- Support of Moreau's time-stepping scheme for solving non-smooth contact problems using constant or varying time integration methods.
- Find the static equilibrium state of a model.
- Conduct advanced simulation scenarios using simulation scripts.

### Design Exploration / Optimization

- Build parametric models to include relationships between several characteristics of a model.
- Run DOE simulations to examine how the variation of several design variables affect the behavior of a model.
- Perform optimization tasks in MBD models using the Optimization tool of ANSA as an orchestrator to connect Kinetics with external optimizers.

### Controls

- Study the inverse dynamics of a system by implementing controllers in MBD models.
- Build simple controllers as block diagrams through a dedicated interface.

### Configurator

- Build user-defined configurations to represent the mechanisms of a model.
- Articulate mechanisms either by applying displacement on joints, by selecting initial and target points, or interactively with a click-drag of the mouse.
- Special handling for articulating mechanisms of water-tight models.
- Completely lock or limit the motion range of selected joints during the articulation of a mechanism.
- Ability to save a mechanism in several different positions.

### Tire modeling

- Implemented tire modeling features to include tires in models and study the forces that act on them.
- Support of the Pacejka Magic Formula (PAC2002) for steady-state and transient conditions.
- Support of the FTire formulation for nonlinear tire behavior with a high-frequency range.
- Quick and simple definition of tires and road profiles through step-by-step wizards.

### Results Viewer

- View simulation results in plots and tables simultaneously.
- Make direct comparisons between results of different simulations that correspond to different versions of a model.
- Apply calculations between plotted curves.
- Export stress time histories of flexible bodies for durability analysis.
- Export results to META for more advanced post-processing capabilities.

### Additional tools

- Specific tools to automatically convert existing FE models that include mechanisms to MBD models.
- Ability to perform various measurements on models, and visualize them as plots during a simulation run.
- Impose sensors to stop a simulation when a user-defined expression has reached a specified value.
- Identification of the trace paths that certain points follow during a simulation and representation as 3D-curves.

### Input/Output

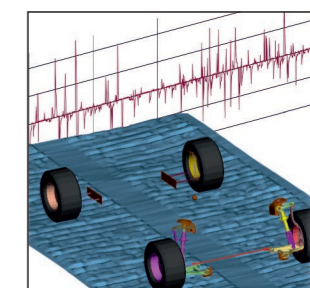
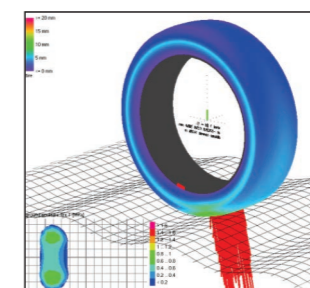
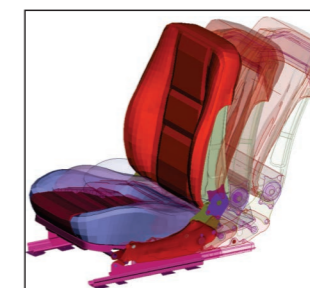
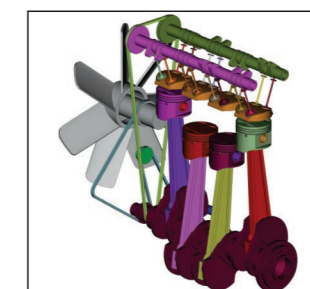
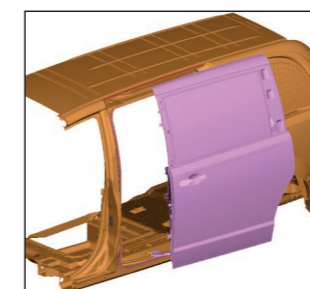
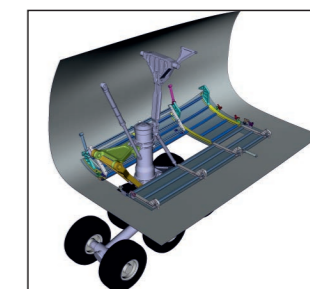
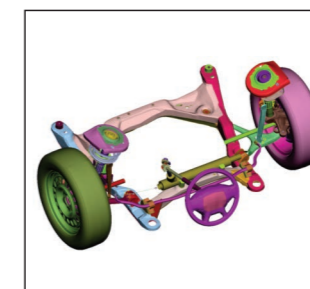
- Import/Export of multibody models for ADAMS and MotionSolve.
- Import RPC files to define data tables.
- Export the transformations of articulated FE models in their native format.
- Kinematic configurations that represent mechanisms, can be exported in the respective PRIMER software format.

### Features

- Include flexible bodies in models for more realistic behavior and accuracy
- Implement controllers through a block diagram interface
- Multibody model buildup automation through script functions
- Definition of forces using user-written script routines
- Ability to create envelopes of moving bodies
- Positioning of mechanisms
- Co-simulation between KINETICS and Ftire for advanced tire modeling
- Parametric simulations to explore design proposals

### Benefits

- Common environment to build FEM and MBD models in parallel
- Ability to create several loadcases for CAE analyses by saving a model in several positions
- Fast and precise modeling of contacts based on the latest theories
- Post-processing of multibody simulations within a single environment
- Combination of KINETICS with other embedded tools of ANSA
- High parameterization of the integrated multibody solver allows users to fine tune their simulations





*physics on screen*

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[www.beta-cae.com](http://www.beta-cae.com)