



## **Kinetics**

**Grasp the dynamic  
behavior of your systems**

## Perform motion tests 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.
- Creation of various types of joint constraints for the definition of the connection between bodies.
- Capability to impose motions on bodies and joints with or without including any initial conditions.
- Application of all types of forces with linear or nonlinear characteristics taking as input function expressions or script functions.
- 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.
- Friction modeling using Planar or Spatial isotropic friction types.
- Inclusion of the drilling friction (friction torque) during contacts.
- Support of the Stribeck effect for more realistic friction behavior.
- High parameterization of the collision detection engine for increased accuracy and performance.

### Simulator

- In-house multibody dynamics solver, within ANSA pre-processor, to run simulations in the time domain.
- Support of the implicit HHT-13 time integration method for solving dynamic problems.
- Support of Moreau's time stepping scheme for solving non smooth contact problems using constant or varying time integration methods.
- Simulations to identify the model's static equilibrium state.
- Configurable multibody dynamics solver for expert users with access to numerous solver parameters.
- Animation controls available for the visualization of

model behavior.

- Additionally, the camera tools enhance visualization experience by offering different view perspectives and focus on specific areas of your model, during animation.

### Design Exploration

- Build parameterized models to include parametric relationships between several characteristics of a model. A change in the value of a single characteristic will update the values of all the related characteristics automatically.
- Run parametric simulations to see how some critical parameters can affect the results of a model. A Design Study will show how a design variable will change the behavior of a model between a range of values. A Design of Experiment (DOE) will show how the simultaneous variation of several design variables will affect the model and which combination of values has the biggest effects.

### Configurator

- User-defined kinematic configurations for representing the mechanisms of a model. Automatic creation of configurations, by converting an existing FE model to a kinematic configuration, with the use of the Automech tool.
- Articulate mechanisms either by applying displacement increments through selecting initial and target points, or interactively with the mouse.
- 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 conditions and interaction with smooth road surfaces.
- Support of the FTire formulation for nonlinear tire

## Features

- Ability to explode a multibody model for better visualization of bodies
- Multibody model buildup automation through script functions
- Forces Magnitude definition using user-written script routines
- Envelopes of moving bodies creation
- Positioning of mechanisms
- Co-simulation between KINETICS and FTire for advanced tire modeling
- Impose detailed output requests to study and evaluate important parameters of a model
- Parametric simulations to explore design proposals

## Benefits

- 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

behavior, high frequency range and interaction with very short wavelength surfaces. This requires co-simulation between ANSA and FTire software.

- Creation of tire and road objects through easy 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 various calculations between plotted curves.
- Ability to export plot curve data in tabular format or export all simulation results data in XML format.

## Input/Output

- Import/Export of multibody models between ANSA and other multibody dynamics software through .cmd files.
- Instead of complete models, users can output, in the respective FE solver output format, only the moved bodies. After a multibody simulation run, it is possible to instantly extract and convert the final velocities of the bodies to initial velocity keywords for a following FE simulation.
- Kinematic configurations that represent mechanisms, can be output in the respective PRIMER software format.

## Additional tools

- 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 markers/nodes followed during a simulation and representation in 3d-curves.



