Real Time computational speed is a pre-requisite when combining software models with hardware components, such as a chassis stability controller, vision / range sensors or a driving simulator (e.g. DiM Driving Simulator by VI-grade). MSC Adams has long been the automotive industry’s tool of choice for vehicle dynamics predictions.

Now, with Adams Real Time, analysts can reuse the same base model for high fidelity off-line simulations, through SiL (Software-in-the-loop) to HiL (Hardware-in-the-loop) and ADAS (Advanced Driver Assistance Systems) applications. This one tool / one model approach has the potential to remove weeks from the typical vehicle development program and save tens of thousands of dollars by eliminating the error-prone model translations between different tools.
Workflow before Adams Real Time

Before Adams Real Time, Adams Car users need to convert the Adams model into a 3rd Party model before he can run hardware-in-the-loop (HIL) simulation. This workflow has 3 drawbacks:

1. 2 different sets of full vehicle models using 2 different tools had to be created
2. Reduced order 3rd party models could not be converted back into the original Adams models
3. Components/topology changes were not possible in some of the 3rd party models

Workflow after Adams Real Time!

With Adams Real Time, engineers can use one Adams model for both high-fidelity simulation and real time analysis. Combining 2 sets of models into one will drastically reduce the amount of work required to convert one model into another, thus improving consistency and increasing workflow efficiency between different departments.
The current release of Adams Real Time (Adams 2017.2) will include the following features:
Continuous enhancements and additional features are in the plans for subsequent releases in 2017.

- **Adams Real Time Integrator** – New fixed-step integrator for faster simulation
- **Real Time Analysis on Concurrent Platform** – Connecting Adams with a hardware controller or a driving simulator
- **Model Fidelity Tuning** – Automated utilities for generating more efficient vehicle models

### Adams Real Time Integrator

The Real Time Integrator in an Adams solver setting allows the user to meet the real time operating system requirements. This Integrator ensures that both the Adams simulation speed and the communication interval meet the real time platform/hardware requirements (e.g. driving simulator, or abs controller).

A fixed step option is introduced for the GSTIFF integrator supporting both the I3 and SI2 formulations and for the HHT integrator. The purpose of the fixed step option is to ensure that a fixed amount of work is completed in a given time to satisfy the requirements for a Linux real time operating system (RTOS). This is achieved by limiting the number of Newton steps in the implicit solve (that is, number of iterations per Adams Solver integration step) to ensure a fixed amount of work is performed.

### Employing the Fixed Step Option in the Adams Solver Language:

**FIXIT:** fixed iterations, the limit on the number of iterations to be taken per integration step.

Must be either unspecified or an integer from 1-10. If specified, the fixed step option is employed. If FIXIT is unspecified, then the fixed step option is not employed and Adams Solver integration proceeds in the traditional manner.

**HRATIO:** the output sampling rate (aka “DTOUT”) divided by the integrator time step size (aka “H”). Must be a positive integer. If unspecified while FIXIT is specified, this defaults to 1.

**MAXERR:** the upper limit of the error that the user would like Adams Solver to stop trying to solve the problem. MAXERR is a positive real number.

As illustrated in the chart above, t₀, t₁, t₂, t₃ and t₄ stand for the output steps. HRATIO is used to decide how many integrations steps there are in one output step, and FIXIT indicates the number of iterations per integration step. Those are the parameters users need to define in order to leverage the Adams Real Time integrator.
Real Time Analysis on SIModelation Workbench Platform

Engineers need Real Time Simulation to connect with a hardware controller or driving simulator. Adams Real Time users stay inside of Adams for both high-fidelity (complex model with high accuracy) simulation and real time analysis for hardware-in-the-loop. Adams Solver supports Concurrent’s Simulatation Workbench® (SimWB) real time modeling environment on the RedHawk™ Linux® operating system.

Adams Solver can now participate in co-simulations performed in the SimWB real time environment. This is achieved via extensions to Adams’ support for the Functional Mockup Interface (FMI). A functional mockup (FMU) unit exported from Adams Controls or Adams Mechatronics within Adams View or Adams Car can now be imported into SimWB. Standalone Adams Solver analyses can be run on the RedHawk Linux operating system.

The Adams Solver is certified in the following environments:
- iHawk® running RedHawk Linux 6.5 with SIModelation Workbench Control Center 7.5
- RedHawk Linux 7.0 with SIModelation Workbench Control Center 7.4

Model Fidelity Tuning

Higher-fidelity component models can represent a significant performance cost in the solve time of a vehicle dynamics model and in many instances sufficiently accurate results can be achieved with a more efficient modeling approach, which is preferable in real time analysis. New in Adams 2017.2 is an automated utility for reducing the modeling fidelity of Adams Car anti-roll bar objects. Users with anti-roll bars modeled via the FE Part or Beam methods are guided in reducing them down to a comparable anti-roll bar modeled via the Simple method (two parts and torsion spring). This involves automated derivation of an appropriate torsion spring stiffness through a series of simulations exercising the anti-roll bar and providing a comparison of the original and simplified models. Users can opt for the auto-derived spring stiffness or re-run the comparison with their own value. Once satisfied with the spring stiffness, one can proceed and the utility will automatically replace the anti-roll bar with the simplified version.

Also new in Adams 2017.2 is an automated utility for reducing the modeling fidelity of tires. Users with tires modeled via FTire, detailed 3rd-party models or the more sophisticated Adams Tire PAC2002 options (for example, transient model, belt dynamics, 3D enveloping contact) are guided in reducing them down to a simpler PAC2002 model. This involves a semi-automated process with a wizard guiding one through the use of the appropriate tools: tire testrig and tire data and fitting tool (TDFT). Finally vehicle models can be updated automatically with the new tire models.