SIEMENS

NX Motion Control Simulation

Co-simulating mechanical motion with control systems

Benefits
- Accelerate product development by reducing design and analysis cycles for new machine designs
- Increase productivity by simulating both mechanical and control systems concurrently
- Rapidly evaluate and validate processes to determine the best controller system
- Reduce need for expensive physical prototypes
- Leverage existing CAD, CAE and controls development investments through seamless integration between NX and MATLAB Simulink
- Eliminate costly changes late in development
- Shorten new machine installation time through controller pretuning done through simulation

Summary
NX™ Motion Control Simulation software enables you to control a motion mechanism using a control system diagram modeled in MATLAB® Simulink® from The Mathworks, Inc. This co-simulation helps the mechanism designer and the control system designer test the interaction between the mechanical and electronic systems early in the design process. Early testing can help verify whether the control system design is robust enough to control the dynamic mechanism and help eliminate costly changes later in development.

Understanding mechatronics systems
Today's products often have various controls using electronics, hydraulics or software. The behavior of the control system impacts the mechanical system and vice versa, so it's critical for mechanical and controls engineers to understand these effects as they develop their systems.

NX Motion Control Simulation meets this challenge through co-simulation,an integrated solver that runs in both NX Motion and MATLAB Simulink. During a

co-simulation, at a specified sampling rate, the control system diagram receives information about the state of the mechanism (such as displacements, velocities, or accelerations) at each time step. The control system responds with instructions that provide input to a joint driver or force or torque load in the mechanism. With the ability to integrate the controllers into the mechanical NX model, you can optimize the dynamics of the system.

Increased productivity
Engineers can increase their productivity by simulating and optimizing both the mechanical and control systems concurrently.

Running a controller integrated simulation is easy and only requires the following steps:

1. Define the mechanical model with NX Motion based on the geometric assembly.
2. Define the plant inputs and plant outputs on the NX Motion model and generate the plant block.
3. Define the controller scheme in Simulink.

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4. Drag-and-drop the NX Motion plant block into the Simulink controller scheme, connect the inputs and outputs.

5. Solve the co-simulation.

Mechanical engineers can view the co-simulation results in NX Motion, or the results can be saved during the co-simulation to a Matlab file (.mat) as well, for controls engineers. Saving the signals for Matlab benefits controls engineers because all Matlab functions for controller tuning or signal analysis can be used later, outside the co-simulation environment.

General capabilities
- Simulate mechanical systems defined with NX Motion along with control systems defined in MATLAB Simulink
- Co-simulation can be run from the NX Motion solution, or from the Matlab Simulink solution, allowing real-time monitoring using scopes

NX Motion plant block
- Plant outputs (mechanism measurement data e.g. displacements, velocities and accelerations, defined in the NX Motion model)
- Plant inputs (signals to the NX Motion model from the control system e.g. forces and torques)
- NX Motion automatically creates the plant block for insertion into the Matlab Simulink control system model

Permanent magnetic direct current (PMDC) motors
- Motors can be defined with NX Motion including their electric properties
- Input to the motor is a voltage signal
- Signals to the motor can be based on the movement of parts of the mechanism through the use of a signal chart that can be defined with a combination of sensors and time.
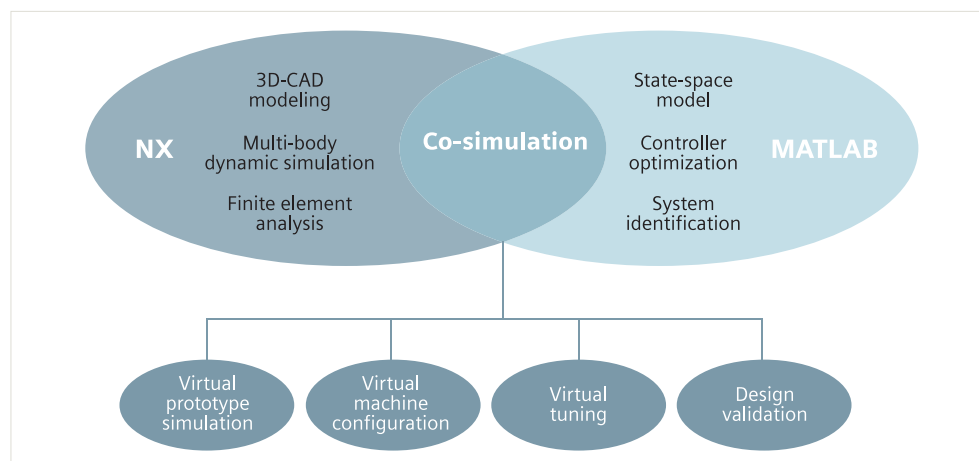- Output is a mechanical torque that drives the mechanism

Supported MATLAB Simulink versions
Matlab Simulink is not packaged with NX Motion. NX Motion links to your existing installation of Simulink.

- R2007a
- R2007b
- R2008a
- R2008b
- R2009
- R2009b
- R2010a
- R2010b
- R2011a
- R2011b
- R2013a
- R2013b
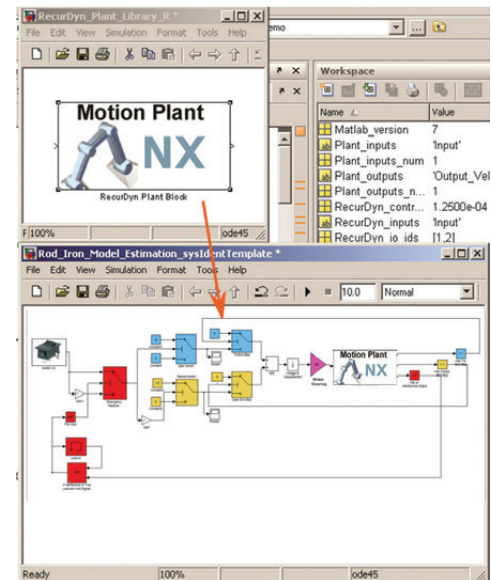
NX Motion plant integrated into control scheme.