Simulink for System and Algorithm Modeling

This course is for engineers who are new to system and algorithm modeling and design validation in Simulink®. It demonstrates how to apply basic modeling techniques and tools to develop Simulink block diagrams. Topics include:

- Creating and modifying Simulink models and simulate system dynamics
- Modeling continuous-time, discrete-time, and hybrid systems
- Modifying solver settings for simulation accuracy and speed
- Building hierarchy into a Simulink model
- Creating reusable model components using subsystems, libraries, and model references

**Prerequisites**
Knowledge of MATLAB basics.

1. **Introduction**
   Objective: Obtain a quick overview of The MathWorks and discuss course logistics.

2. **Introduction to System Modeling**
   Objective: Become familiar with system modeling in Simulink and the electronic throttle control system.
   - System modeling in the Simulink environment
   - Electronic throttle control model

3. **Creating and Simulating a Model**
   Objective: Create a simple Simulink model, run simulations, and analyze the results.
   - Define the potentiometer system
   - Become familiar with the Simulink interface
   - Create a Simulink model of the potentiometer system
   - Run simulations and analyze results

4. **Modeling Programming Constructs**
   Objective: Use Simulink to model and simulate basic programming constructs.
   - Model comparisons and decision statements
   - Create and use vector signals
   - Use the Embedded MATLAB Function block

5. **Modeling Discrete Systems**
   Objective: Use Simulink to model and simulate discrete systems.
   - Define discrete states
   - Create a model of a PI controller
   - Model discrete transfer functions and state space systems
   - Model multirate discrete systems

6. **Modeling Continuous Systems**
   Objective: Use Simulink to model and simulate continuous systems.
   - Define the throttle system
   - Create a model for the throttle system
   - Define continuous states
   - Run simulations and analyze results
   - Model impact dynamics

7. **Solver Selection**
   Objective: Select a solver that is appropriate for a given Simulink model.
   - Solver options
   - Discrete solvers
   - Continuous solvers
   - Zero-crossing detection
   - Algebraic loops

8. **Developing Model Hierarchy**
   Objective: Use subsystems to combine smaller systems into larger systems.
   - Subsystems
   - Bus signals
   - Masks

9. **Combining Models into Diagrams**
   Objective: Use model referencing to combine models.
   - Overview of model referencing and subsystems
   - Set up a model reference
   - Use model reference simulation modes
   - View signals in referenced models
   - Store parameters in referenced models

10. **Creating Libraries**
    Objective: Use libraries to create and distribute custom blocks.
    - Create new libraries
    - Create configurable subsystems
    - Add libraries to the Library Browser
    - Compare libraries and model references

11. **Introduction to Model-Based Design**
    Objective: Discuss how the Simulink environment can be used for Model-Based Design.
    - Traditional system design process
    - Model-Based Design in the Simulink environment

12. **Conclusion**
    Objective: Find resources for further information and training on the topic. Evaluate the class.
    - Resources
    - Related training courses
    - Evaluations