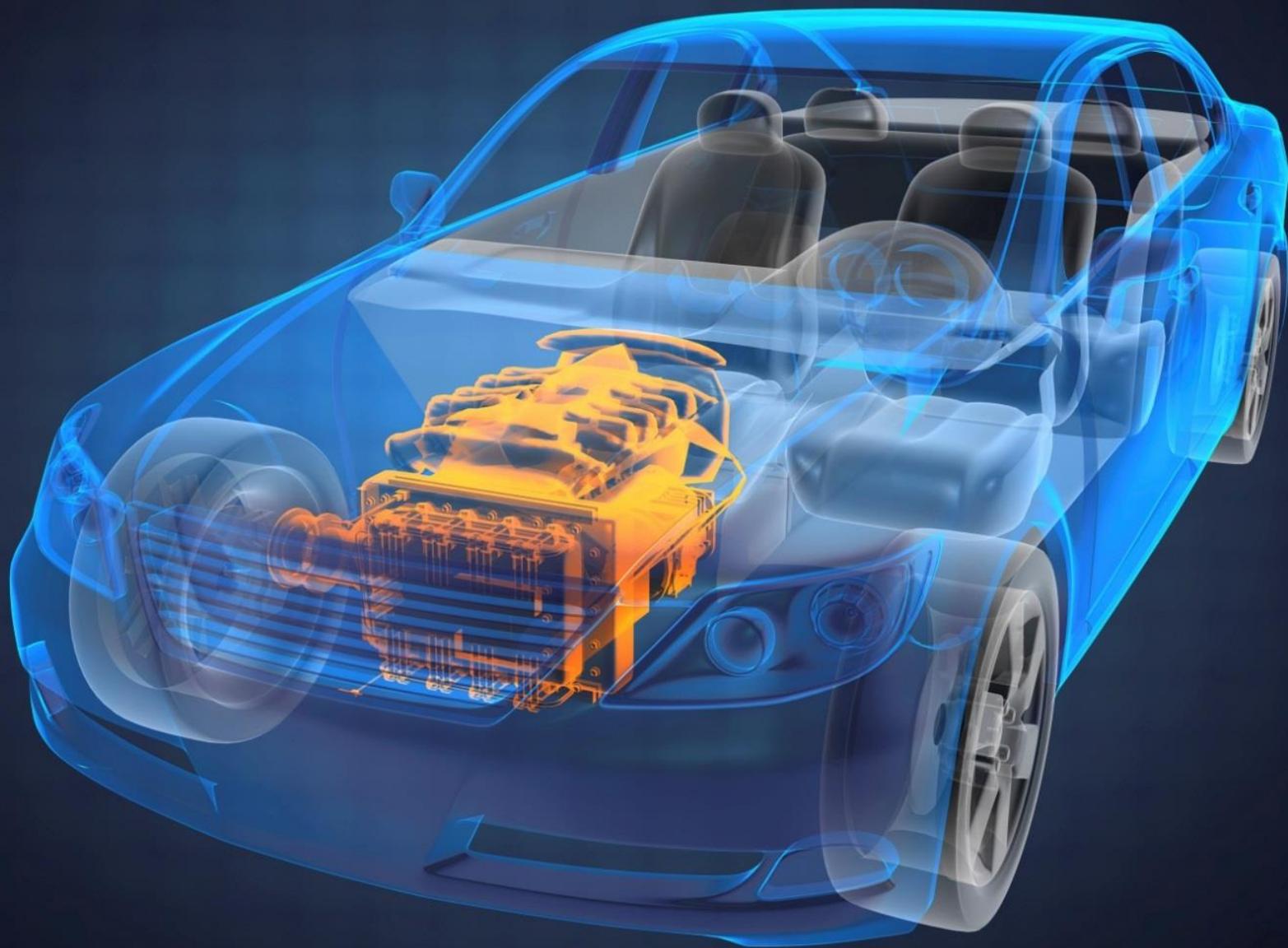


仿真测试: 你充分利用了吗?

Meaghan O'Neil
Simulink Test 产品经理



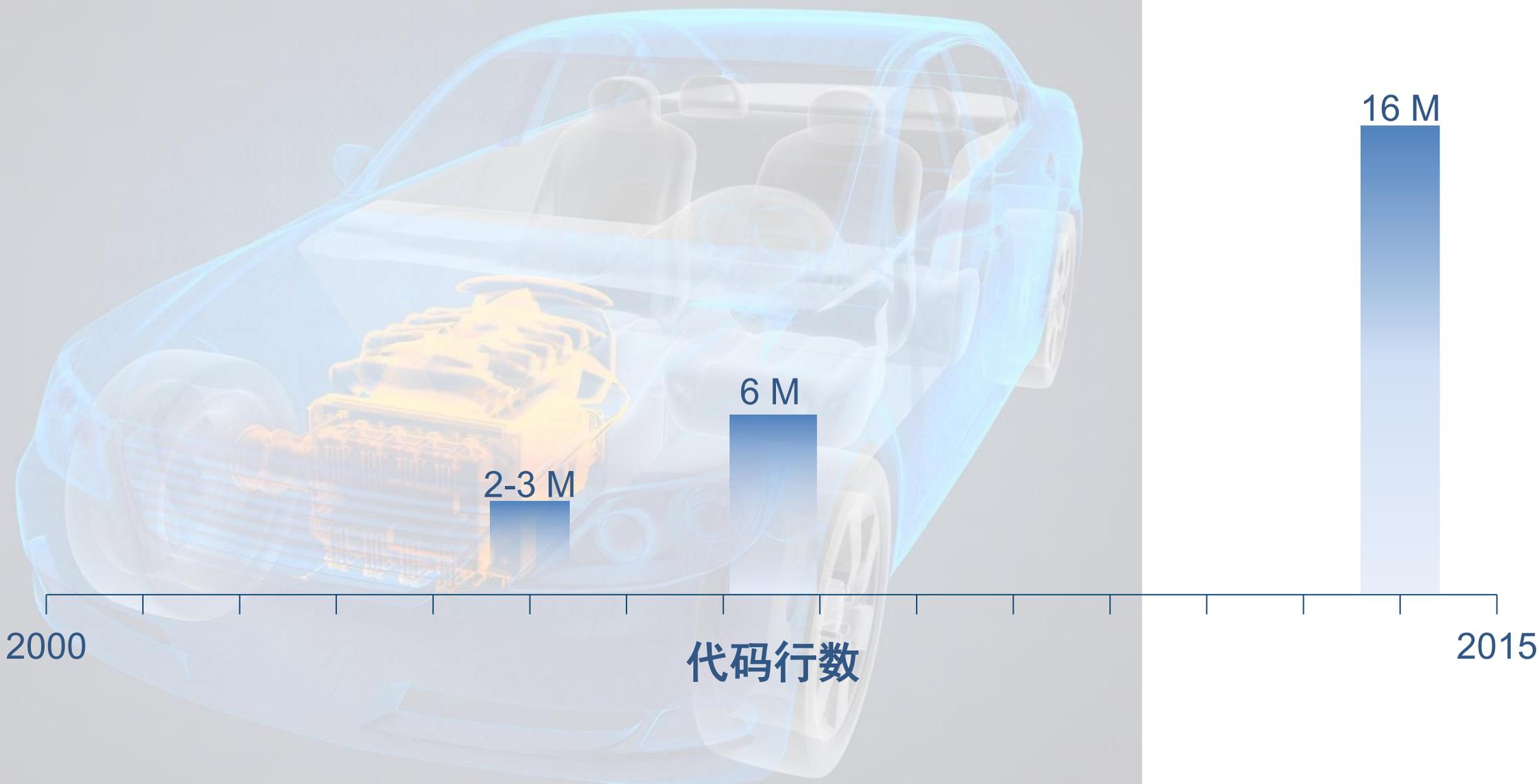
变速箱

发动机

车身控制

娱乐

驾驶辅助



Siemens, ["Ford Motor Company Case Study,"](#) Siemens PLM Software, 2014

McKendrick, J. ["Cars become 'datacenters on wheels', carmakers become software companies,"](#) ZDJNet, 2013

道路复杂性



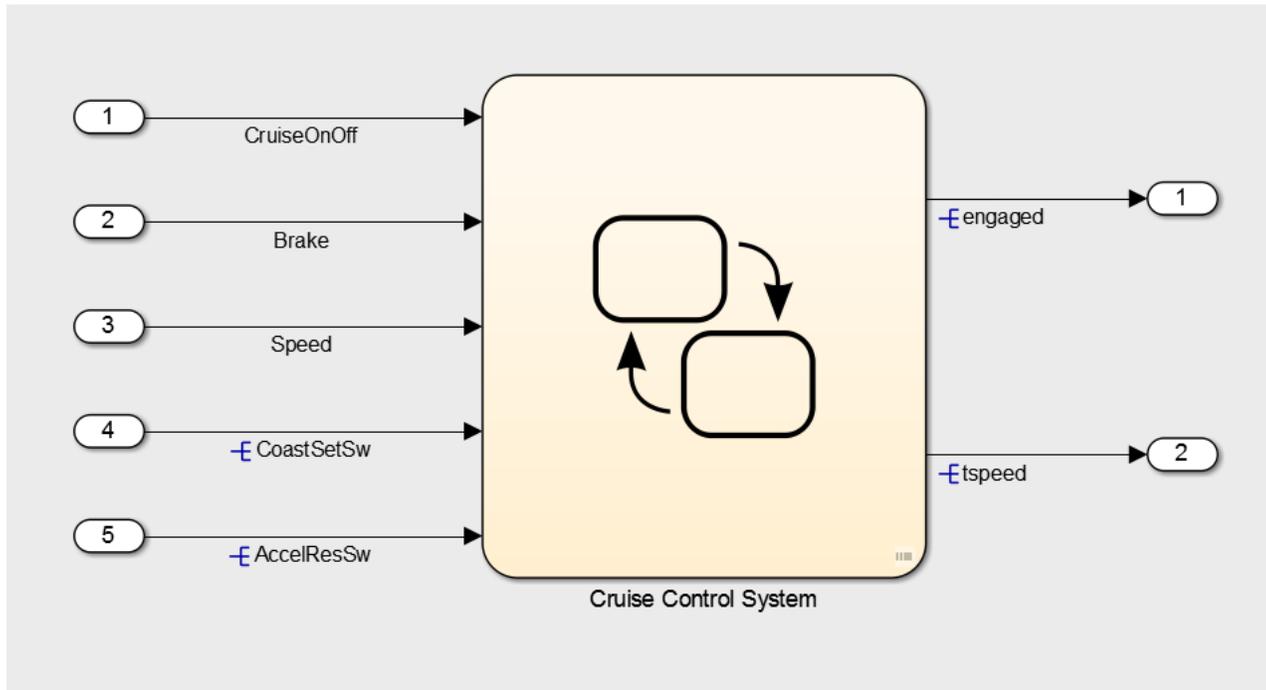
道路复杂性



50

归因于
电子和
嵌入式软件
的
保修成本
百分比

仿真测试：验证与确认



模型的行为满足与期望一致吗？

代码的行为与期望一致吗？

这是正确的行为吗？

基于模型的设计和测试用于开发复杂系统

当前的测试实践

困难:

无/有限测试

有限的模型测试
车辆测试

- 故障排查
- 返工
- 一致性

大量测试

回归测试
单元测试
集成测试
代码测试
车辆测试

- 投资
- 定制化
- 可持续性

用户反馈

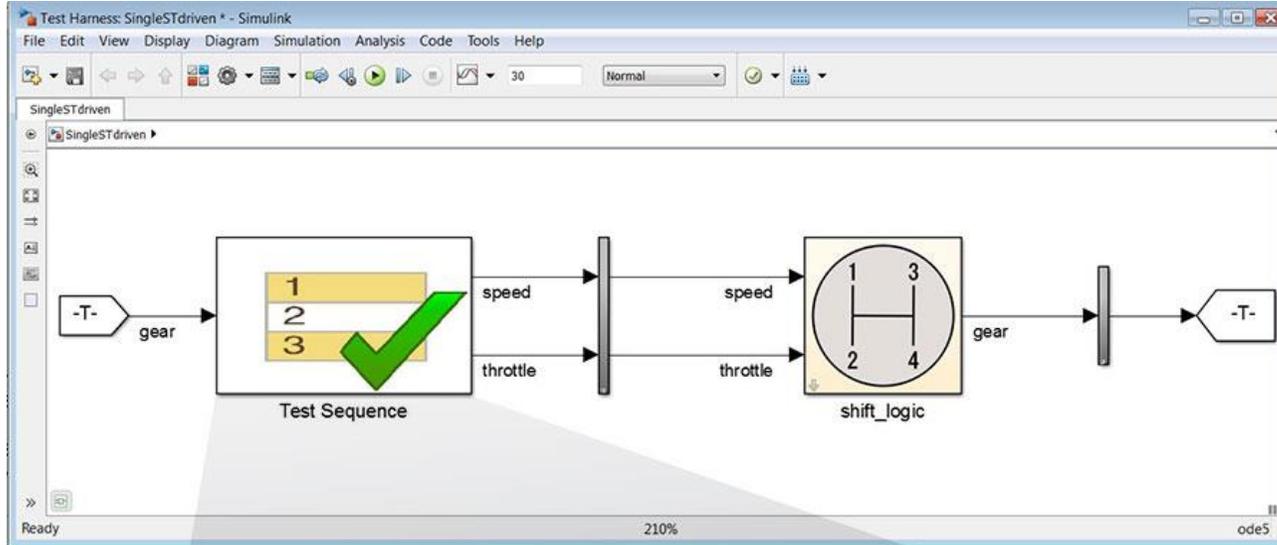
需要改善模型和生成的代码的验证与确认
把验证与确认工作无缝集成到设计流程中

MathWorks 测试相关的产品

产品	功能
15a新 产品 Simulink Test	编写、执行和管理模型和自动生成代码的基于模型测试
Simulink Verification & Validation	跟踪需求，建模标准检查，执行覆盖率分析
Simulink Design Verifier	检测设计错误，自动产生测试向量，比对需求验证设计
Polyspace Bug Finder	找出软件漏洞并检查是否符合 MISRA标准
Polyspace Code Prover	证明软件不存在运行时错误

创建输入向量和测试评估

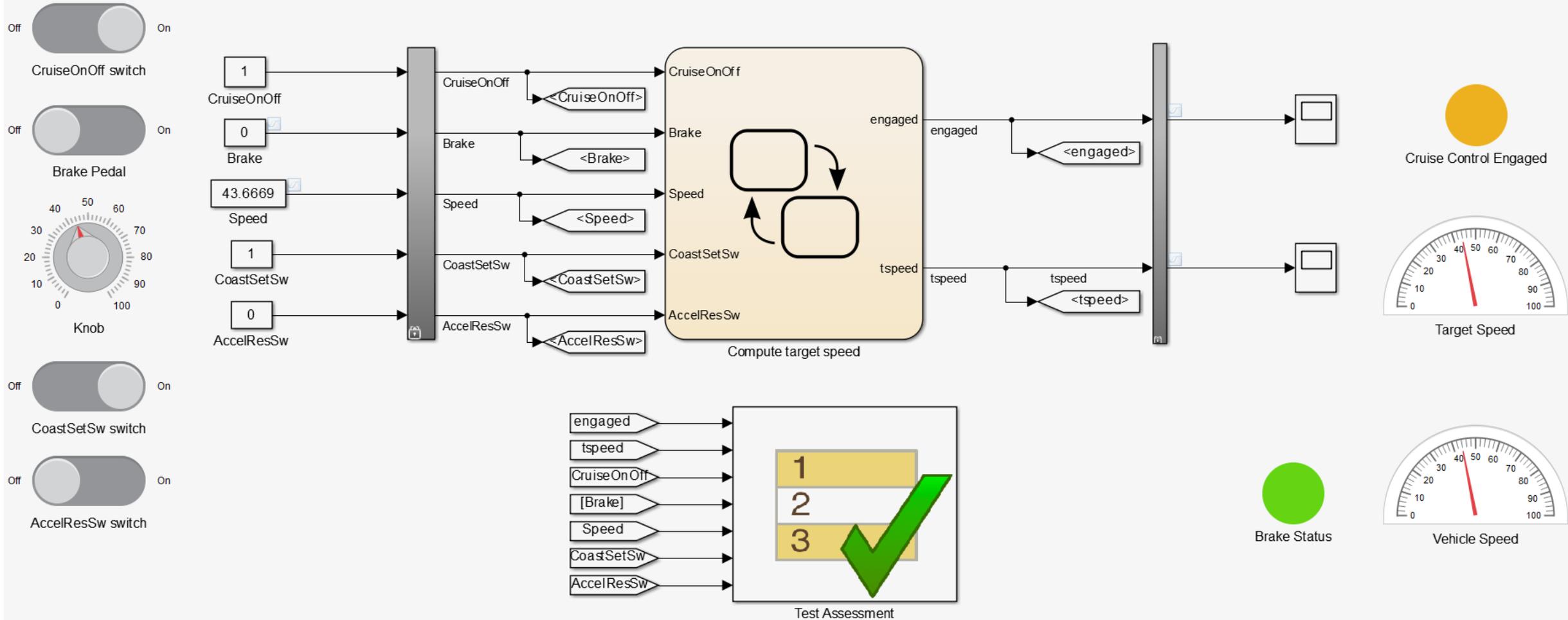
测试序列模块完美匹配时间序列数据



使用基于时间或逻辑的条件
创建输入向量和测试评估

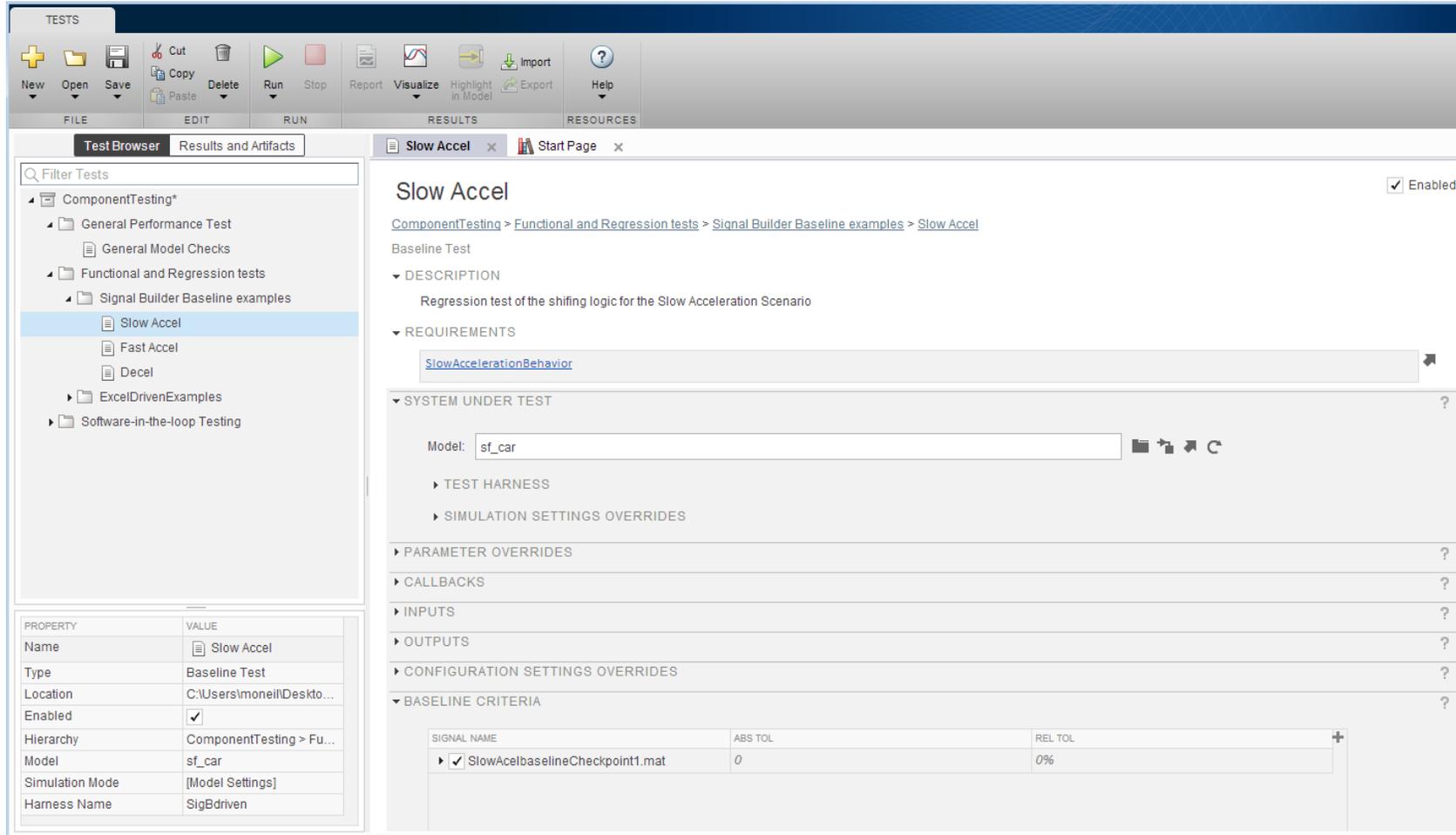


交互性测试及可复用性



自动化测试

测试管理用于编写、执行和组织测试用例和结果



The screenshot displays the MathWorks Test Manager interface. At the top, there is a toolbar with icons for file operations (New, Open, Save, Cut, Copy, Paste, Delete), execution (Run, Stop), and reporting (Report, Visualize, Highlight in Model, Export, Import, Help). Below the toolbar, the 'Test Browser' pane on the left shows a hierarchical tree of test cases, with 'Slow Accel' selected under 'Signal Builder Baseline examples'. The main area shows the configuration for the 'Slow Accel' test, which is a 'Baseline Test' for the 'sf_car' model. The configuration includes sections for 'DESCRIPTION', 'REQUIREMENTS' (linked to 'SlowAccelerationBehavior'), 'SYSTEM UNDER TEST', 'TEST HARNESS', 'SIMULATION SETTINGS OVERRIDES', 'PARAMETER OVERRIDES', 'CALLBACKS', 'INPUTS', 'OUTPUTS', 'CONFIGURATION SETTINGS OVERRIDES', and 'BASELINE CRITERIA'. The 'BASELINE CRITERIA' section contains a table with columns for 'SIGNAL NAME', 'ABS TOL', and 'REL TOL'.

SIGNAL NAME	ABS TOL	REL TOL
SlowAccelbaselineCheckpoint1.mat	0	0%

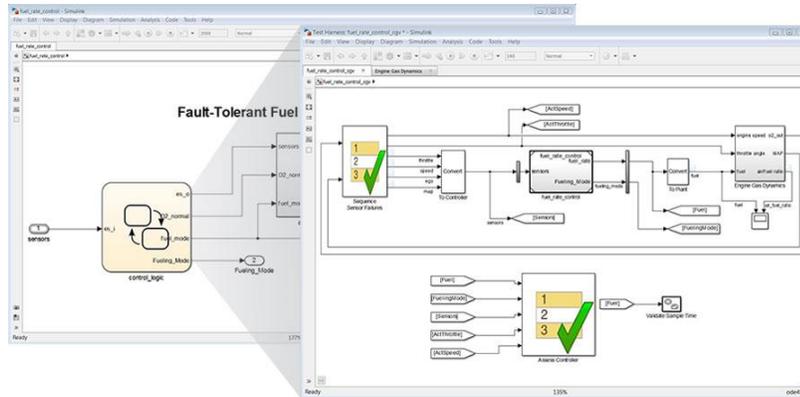
At the bottom left, a 'PROPERTY' table provides details for the selected test:

PROPERTY	VALUE
Name	Slow Accel
Type	Baseline Test
Location	C:\Users\lmonell\Desкто...
Enabled	<input checked="" type="checkbox"/>
Hierarchy	ComponentTesting > Fu...
Model	sf_car
Simulation Mode	[Model Settings]
Harness Name	SigBdriven

- 从模板创建测试用例
- 自定义设置和清除脚本
- 浏览、分享、报告测试结果

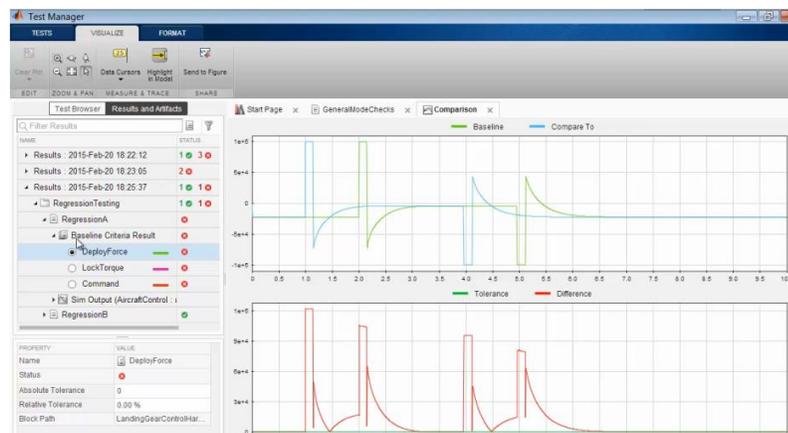
R2015a新产品: Simulink Test

分离



测试

分析

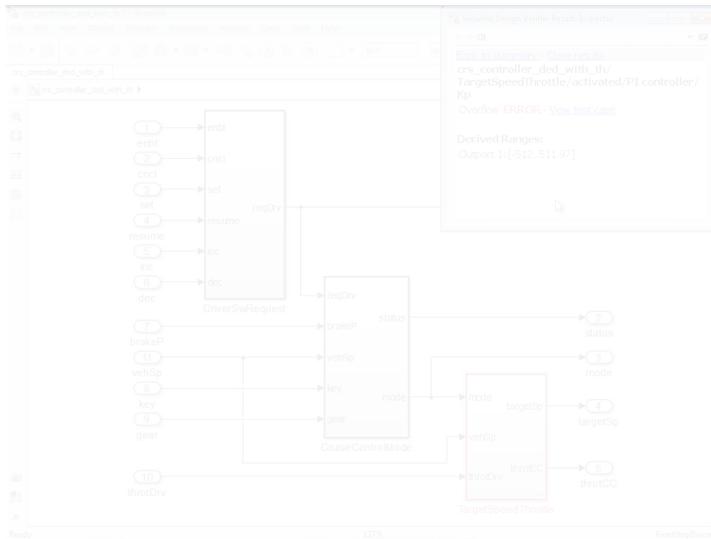


复用

- 1 General Performance Test
 - General Model Checks
- 2 Functional and Regression tests
 - Signal Builder Baseline examples
 - ExcelDrivenExamples
- 3 Software-in-the-loop Testing
 - SILtest

示例： 第一步:隔离并修正错误

主模型

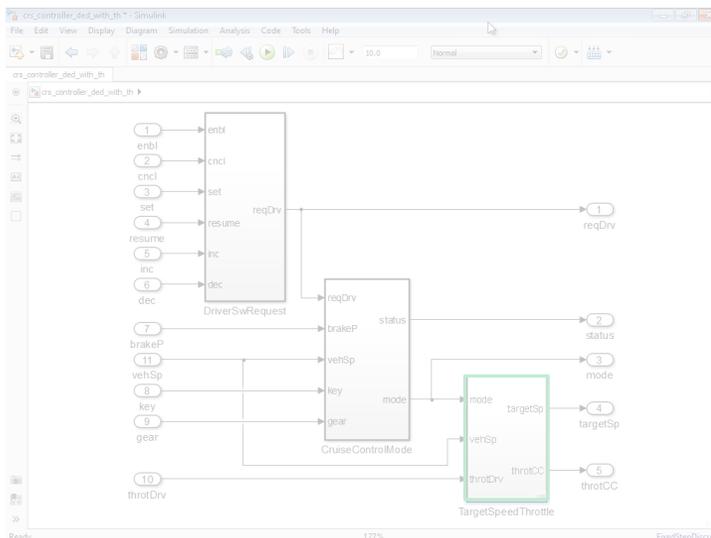


1. 主模型发现的错误

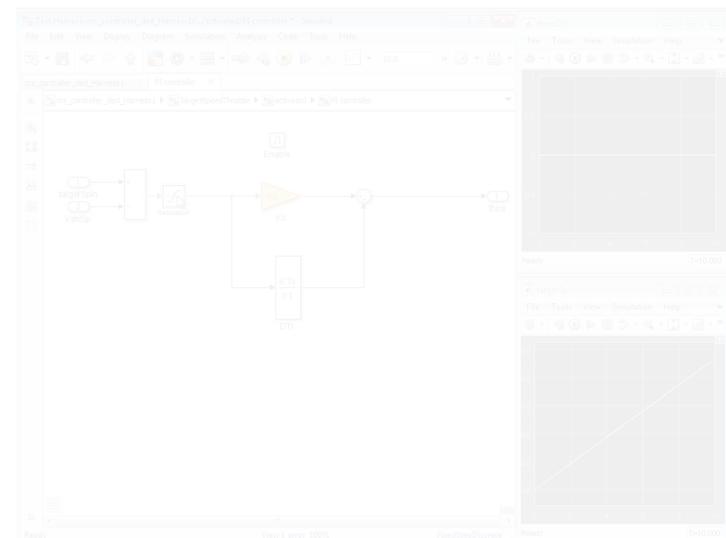
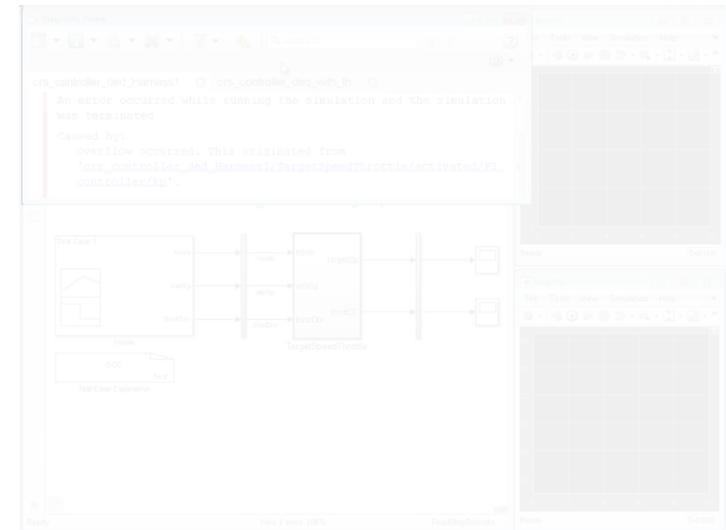
2. 隔离组件并在测试环境分析错误

3. 在测试环境解决错误并确认已修复

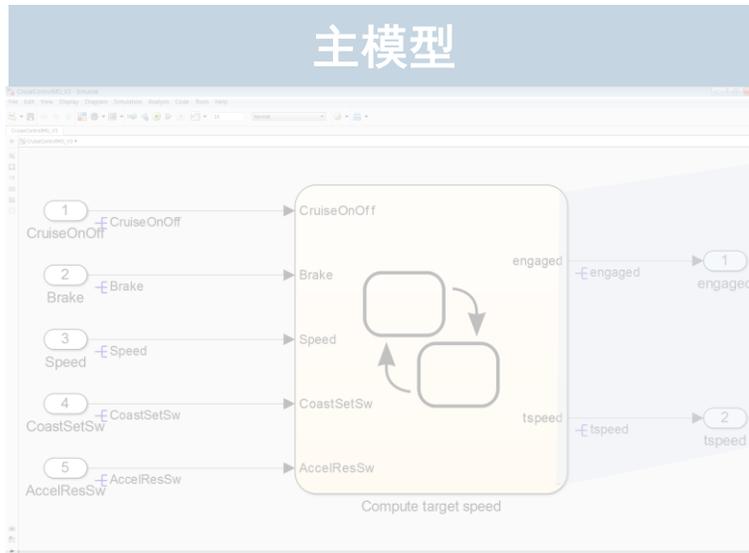
4. 同步更新到主模型



测试环境



示例：第二步：隔离组件、测试场景

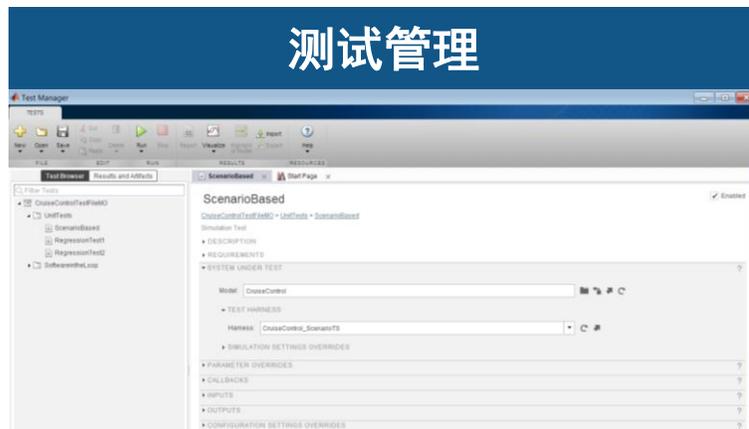


1. 隔离



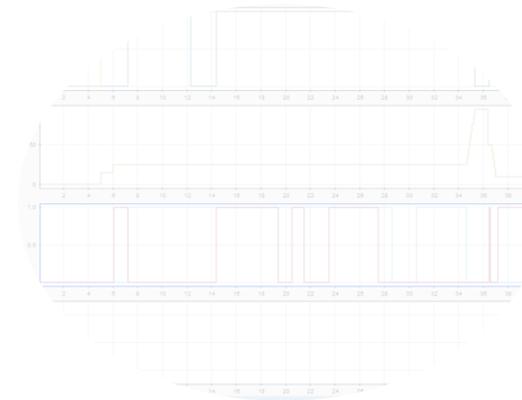
2. 编写输入向量、进行评估

Step	Transition	Next Step
step_1_Initialize CruiseOnOff = false; Brake = false; Speed = uint8(0); CoastSetSw = false; AccelResSw = false; assert (engaged == 0, 'Engagedwhen CruiseOff');	1. after (5, sec)	step_2
step_2 %SetSpeedbeforeEngaging CruiseOnOff = true; Pass = 0;	1. Pass == 1	step_3



4. 编写测试用例

3. 显示输入向量和结果



5. 执行测试

6. 报告

Report Generated by Test Manager

Title: Test
Author: M O'Neill
Date: 07-Jun-2015 11:47:36

Test Environment
Platform: PCWIN64
MATLAB: (R2015e)

▶ Results : 2015-Jun-07 11:45:50 1

示例 第三步: 交互式测试

测试环境

The screenshot shows a Simulink test environment. On the left, a test sequence is displayed with three steps, the third of which is marked with a green checkmark. The main area shows a Simulink model with various input and output ports. On the right, a 'Test Assessment' window shows a list of test steps, with the third step also marked with a green checkmark.

```

Step
step_1
  assert (CruiseOnOff==0, 'step_1 System should start in the off position')
  assert (engaged==0, 'step_1 System should start disengaged')
  InitialSet=0;
  InitialEngaged=0;

  PrevAccel = AccelResSw;
  PrevDec = CoastSetSw;
  PrevEngaged = engaged;
  PrevOnOff = CruiseOnOff;
  PrevSpeed = Speed;
  Pass=1;

step_2
  PrevAccel = AccelResSw;
  PrevDec = CoastSetSw;
  PrevEngaged = engaged;
  PrevOnOff = CruiseOnOff;
  PrevSpeed = Speed;

  if tspeed==0
    assert (tspeed<=90, 'speed should not be above 90 and is currently %d', tspeed)
    assert (tspeed>=20, 'speed should not be below 20 and is currently %d', tspeed)
  end

  if CoastSetSw == true
    InitialSet=1;
  end

  if engaged == true
    InitialEngaged = 1;
  end

step_2.4 when Brake==1 || Speed >90 || Speed <20 || CruiseOnOff==0
  assert (engaged==0, 'step_2 system should not be engaged')
  
```

1. 编写可重用的功能性评估

Interactive Testing with Functional Assessments

The diagram illustrates the interactive testing process for a cruise control system. On the left, physical controls are shown: CruiseOnOff switch, Brake Pedal, Knob, CoastSetSw switch, and AccelResSw switch. These are connected to a Simulink model block labeled 'Compute target speed'. The model has several input ports: CruiseOnOff, Brake, Speed, CoastSetSw, and AccelResSw. The model outputs 'engaged' and 'tspeed'. On the right, the outputs are visualized: a yellow light for 'Cruise Control Engaged', a speedometer for 'Target Speed', a green light for 'Brake Status', and another speedometer for 'Vehicle Speed'. A 'Test Assessment' window is shown at the bottom right, with a green checkmark indicating a successful test.

2. 使用功能性评估进行交互式测试

- 构建期望的输出
- 记录输入向量

系统仿真测试

我们将持续改进产品以提高复杂系统的设计和测试

质量

开发成本

上市时间

MAC期间了解Simulink Test的机会

今天:

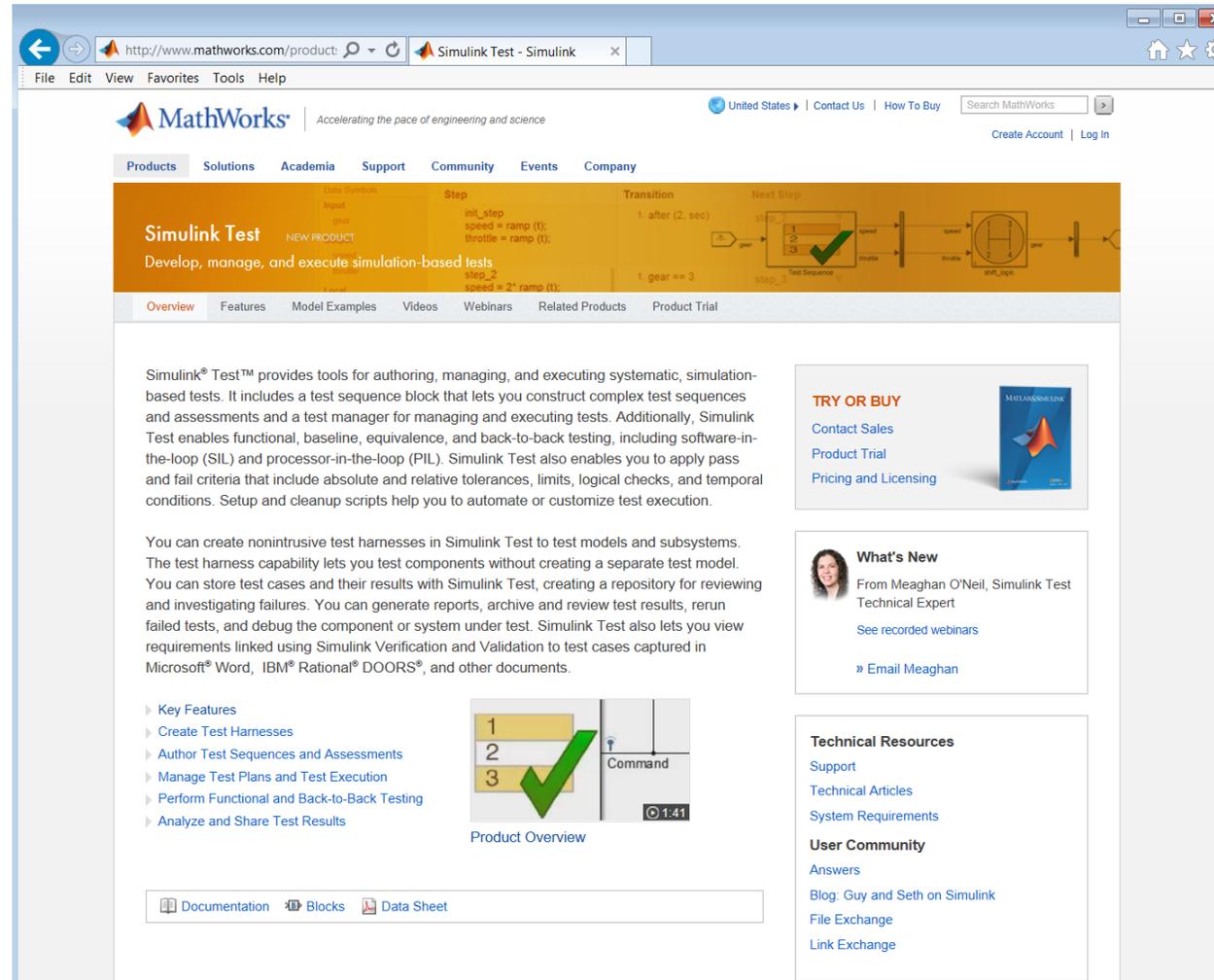
- Simulink Test 展台

明天:

- 上机操作:
在验证与确认流程中使用 *Simulink Test*
- 9:00-12:00 am /南洋计算机培训中心

请访问我们的官方网站了解更多内容

www.mathworks.com/products/simulink-test/



The screenshot shows the MathWorks website for Simulink Test. The page features a navigation menu with options like Products, Solutions, and Academics. A prominent banner at the top reads "Simulink Test: Develop, manage, and execute simulation-based tests". Below this, there is a detailed description of the product's capabilities, including a section on "Key Features" with links to "Create Test Harnesses", "Author Test Sequences and Assessments", "Manage Test Plans and Test Execution", "Perform Functional and Back-to-Back Testing", and "Analyze and Share Test Results". A video thumbnail titled "Product Overview" is also visible. On the right side, there are sections for "TRY OR BUY" (with links for Contact Sales, Product Trial, and Pricing and Licensing), "What's New" (featuring a quote from Meaghan O'Neil, Simulink Test Technical Expert), and "Technical Resources" (including Support, Technical Articles, System Requirements, User Community, Answers, Blog, File Exchange, and Link Exchange).