主题演讲: 传感、计算、通信和控制的融合变革

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Worldwide Industry Marketing Director
MathWorks
Three Key Points

1. Technologies are fusing together to transform industries, companies, employment, and education.

2. This is happening now, in your work. Many industries, many applications, many markets.

3. MATLAB & Simulink form a technical foundation for this fusion and transformation.
Software update magically makes the Tesla Model S P85D even faster
Over-the-air update will knock 0.1 second off 0-60 time, says Musk
Road & Track 29 January 2015

Tesla Motors’ Over-the-Air Repairs Are the Way Forward
Tesla and GM have both issued fire-related recalls, but Tesla’s fix doesn’t require owners to bring their cars in.
MIT Technology Review 14 January 2014

Tesla Says It Will Now Be “Impossible To Run Out Of Range Unintentionally” In A Model S
techcrunch.com 19 March 2015
An Apple car? Computer firm hires automotive engineers
Reports suggest Apple employees are designing and building a car

Ford Opens New Silicon Valley Research Center Led By Former Apple Engineer
Google testing drones that could provide Internet access to remote lands
Google plans tests in New Mexico using solar-powered unmanned aircraft.

SpaceX launch illustrates NASA’s growing use of private companies

Cubesats explained and why you should own one

Tesla press conf at 9am on Thurs. About to end range anxiety ... via OTA software update. Affects entire Model S fleet.
9:35 AM - 15 Mar 2015

Amazon unveils fantastic plan: delivery by drone

Facebook lays out its roadmap for creating internet-connected drones
Computing
Control
Communication
Sensing
Computing
Powerful, low-cost sensors and cameras

Cars today have 100 or more sensors!
Unlimited computing power
Range of computing choices

- Custom ASIC
- Microcontroller
- FPGA
- Programmable SOC
- Microprocessor
4G and beyond

2G – 1992
- Voice
- Messages

3G – 2002
- Data
- Positioning

4G – today
- Video Conferencing
- 3D Graphics

5G – 2020
- Automation Control
- Things 2.0

Evolution from 2G to 5G, Source: TU Dresden 2013a
Model-Based Design enabled us to reduce labor costs by 30%, cut testing costs by 20%, and increase productivity by more than 30%.

More than 340,000 effective lines of code for the production ECU

Checked compliance with modeling standards

Linked textual requirements to the model to ensure traceability

Verified control design through closed-loop simulation

Generated test vectors to achieve complete model coverage

Model-Based Design

Weichai Power: 潍柴动力: Fully-tested production ECU in 36 months
Cars processing video in real time
“Traffic sign recognition in driver assistance systems - MATLAB at Continental”
Dr Alexander Behrens, Continental, MATLAB Expo, July 2014, Munich, Germany.

“MATLAB is used in daily work for development and evaluation of driver assistance functions”

“Engineers having good MATLAB programming skills are in high demand”

Machine Learning done with
Image Processing Toolbox
Signal Processing Toolbox
Statistics and Machine Learning Toolbox
Cars controlled with **video** and **radar**

**Coder Code Performance**

**Conclusions:**

- Reliable. Coder code has been used in production code for half a year and no bug is found;
- Efficient. This improved alignment algorithm with coder code can run as fast as previous old algorithm with hand code.
- Easy to integrate.
Advanced Driver Assistance Systems (ADAS)

from “Advanced Driver Assistance Systems Market” Continental AG, KSAE 2011
Cooperating assistance systems – Automated Highway Systems

Dynamic platooning algorithm for intelligent cars

Developing In-Vehicle Traffic Jam Alleviation Technology for Android Using Simulink
Transformation happens when these combine
Transformation happens when these combine
Big Data from the Internet of Things
How will we *design* these multi-domain systems?
Human Machine Interface (HMI) Is Transformed

Primary Flight Display

Instrument Cluster

Heads-up Display

Center Stack

Images provided by DiSTI Corp. Reused with permission.
Images provided by Presagis Corp. Reused with permission.
Model-Based Design for HMI Development

Complete design modeled and tested with MATLAB, Simulink, and Stateflow
Thought-controlled prosthetics
How will we test and verify them?
Certification standards for safety & reliability appearing across industries

Alstom France
Propulsion Control Systems

ISO 26262

IEC 61508

EN-50128

Alstom Grid UK
HDVC Power Systems

IEC 62304

ARP-4754

DO-254

GM USA
Hybrid Powertrain

DO-178

Weinmann Medical DE
Transport ventilator

Eurocopter France
Air Conditioning

MTU Germany
Nuclear Emergency Generators

IEC-60880
How will we train engineers?
Demand for the T-shaped engineer... 

Broad knowledge 

Deep knowledge 

...met with Project-Based Learning.
... in a world of distributed innovation.

“We’re moving to distributed innovation processes. The innovation going on in the rest of the world can probably overwhelm what companies can do internally.”

James Cash, Harvard Business School

WELCOME TO THE MAKER–INDUSTRIAL REVOLUTION

How GE, Local Motors, and an army of DIY inventors are rebuilding American manufacturing

Popular Science, 15 January 2015
MATLAB and Simulink in Production Programs

- IVECO: Shift Range Inhibitor System for 9- and 16-Speed Transmissions
- CNH: Forage harvester Intellifill™ system
- Vodafone: Telematics
- Caterpillar: Electronics
- GM: HVAC
- Lear: BCM
- Dongfeng: BMS
- Delphi Radar
- Bosch e-bike
- Cummins: EMS
- Daimler: vehicle controller
- Weichai Common-Rail Diesel ECU
- SAIC: Roewe 750 hybrid ECU
- Daimler: vehicle controller
- GM: HVAC
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Weichai Common-Rail Diesel ECU

CNH: Forage harvester IntelliFill™ system

IVECO: Shift Range Inhibitor System for 9- and 16-Speed Transmissions

SAIC: Roewe 750 hybrid ECU

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Delphi Radar Computing

Vodafone: Telematics

Cummins: EMS

Caterpillar: Electronics

GM: HVAC

Lear: BCM

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SAIC: Roewe 750 hybrid ECU
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Next Steps

• Attend the talks and exhibits

• Talk to your colleagues – from MathWorks and other companies and academies

• Learn from each other, share best practices across industries and applications

• Use these tools and methods to transform your application and industry!