



Advanced Automotive Technology trends and Model Based Design Approach

U.S. Karle
ARAI

ARAI - an Overview



Corporate Office
ARAI, Kothrud, Pune



Forging Industry Division
ARAI-FID, Chakan, Pune



Homologation & Technology Centre
ARAI-HTC, Chakan, Pune

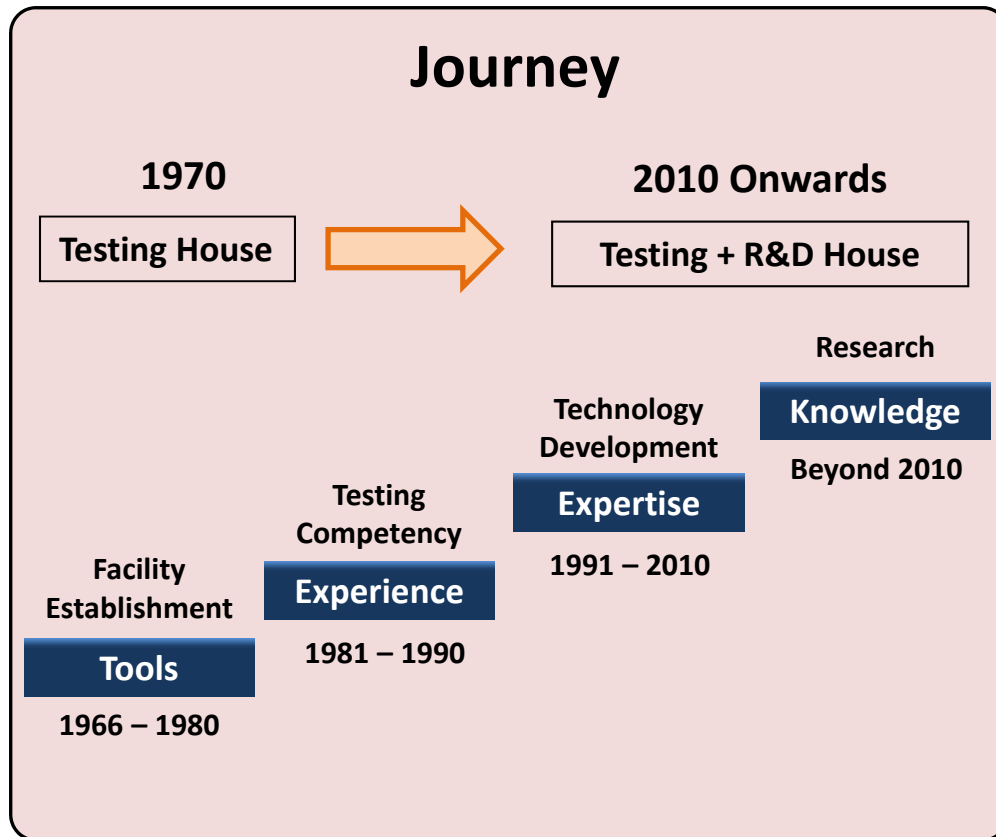
- Established in 1966 at Pune, India
- Human Resource of 680+
- Facilities & Infrastructure: Rs.720 Crore
- Affiliates in China & Korea
- Accredited with
 - ISO 9001, 14001
 - OHSAS 18001
 - NABL (ISO/IEC 17025)

Laboratories:

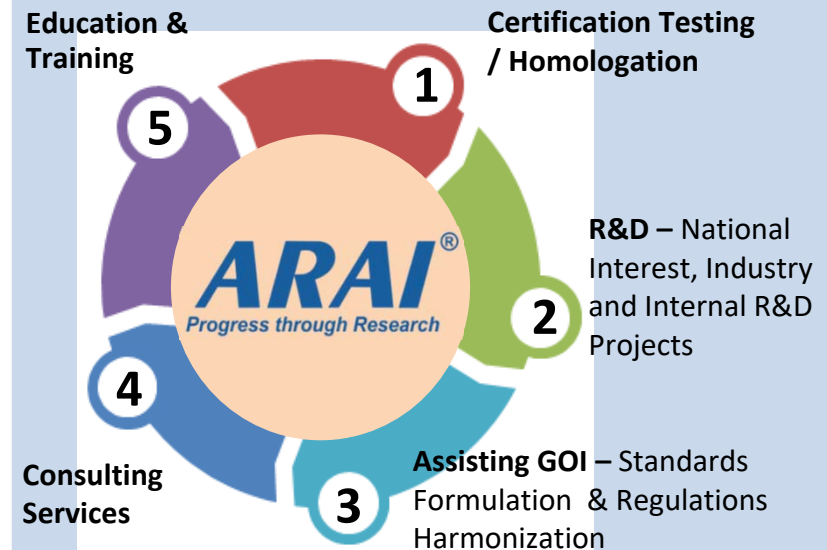
- Powertrain, Emissions, Passive Safety, Safety & Homologation, Vehicle Evaluation, Materials, Automotive Electronics, Structural Dynamics, NVH, CAE, Calibration
- Academy
- Forging Industry Division
- Homologation and Technology Centre
- Regional Centre South Chennai

Transformation- The Essence for Progress

Journey

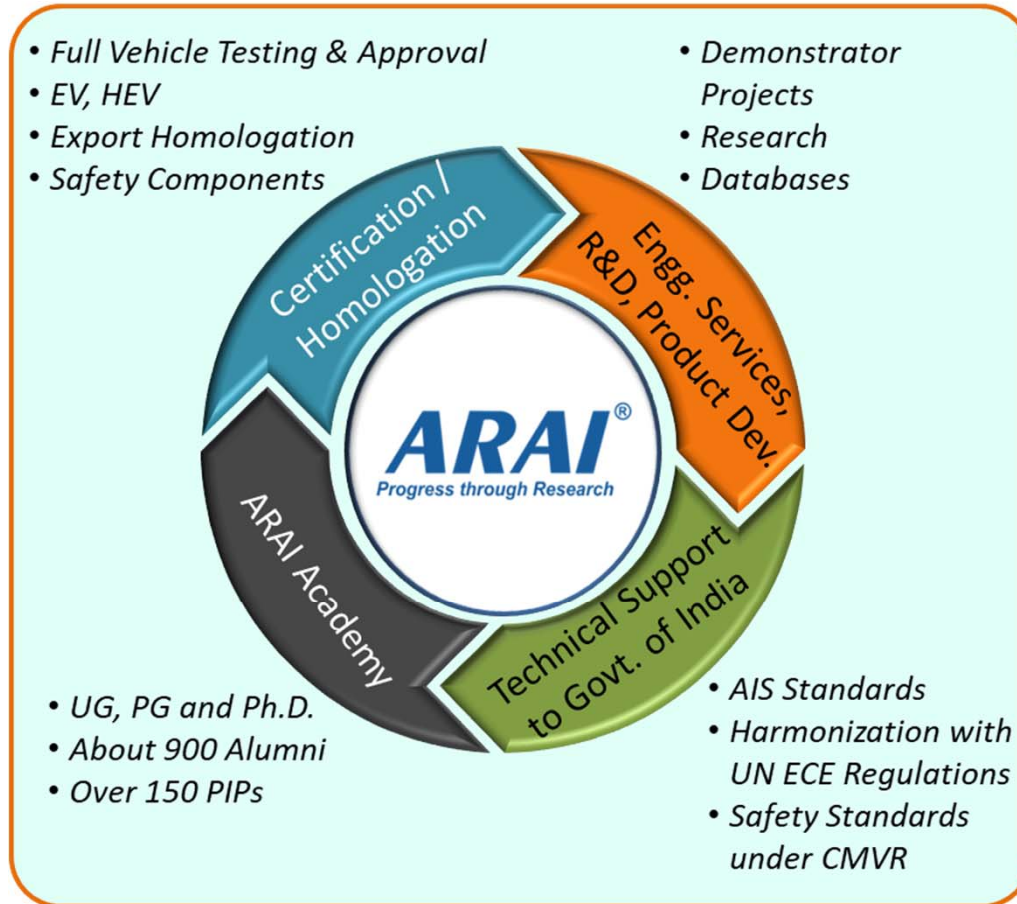


Service Portfolio

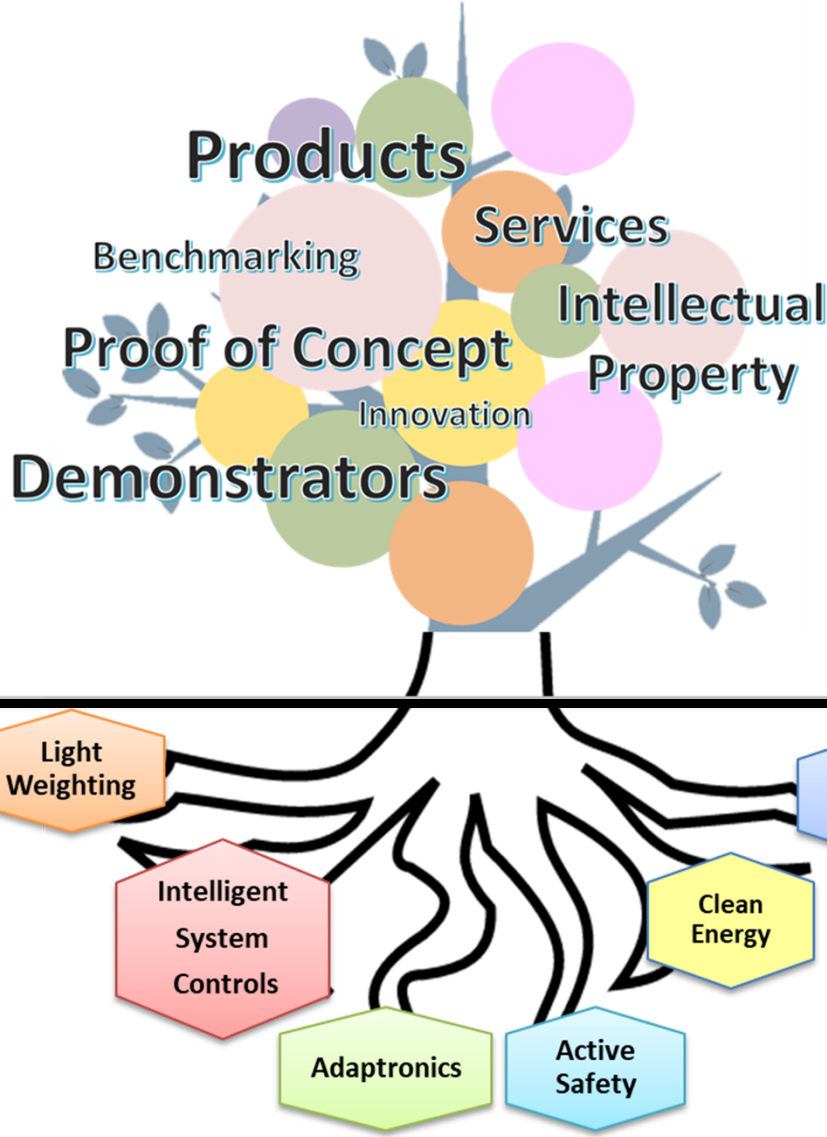
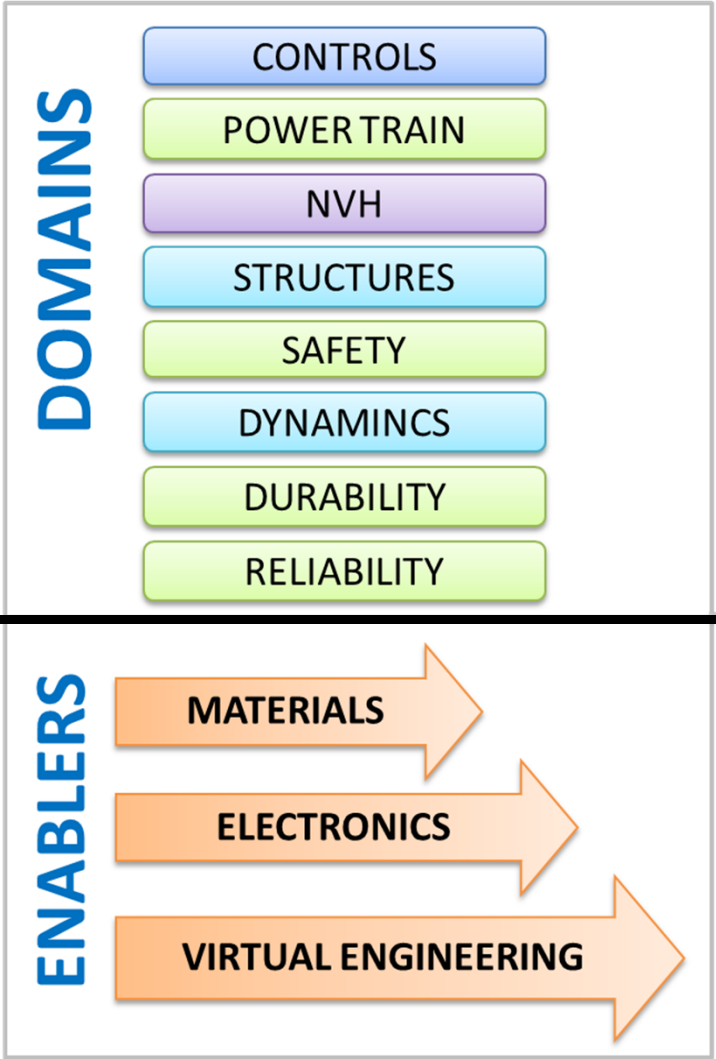


50 Years of Building Automotive Excellence (1966 – 2016)

Technology Drivers



Endeavor to Engineer Solutions...



International Technology Trends



Connected Automated Shared Electrified Mobility

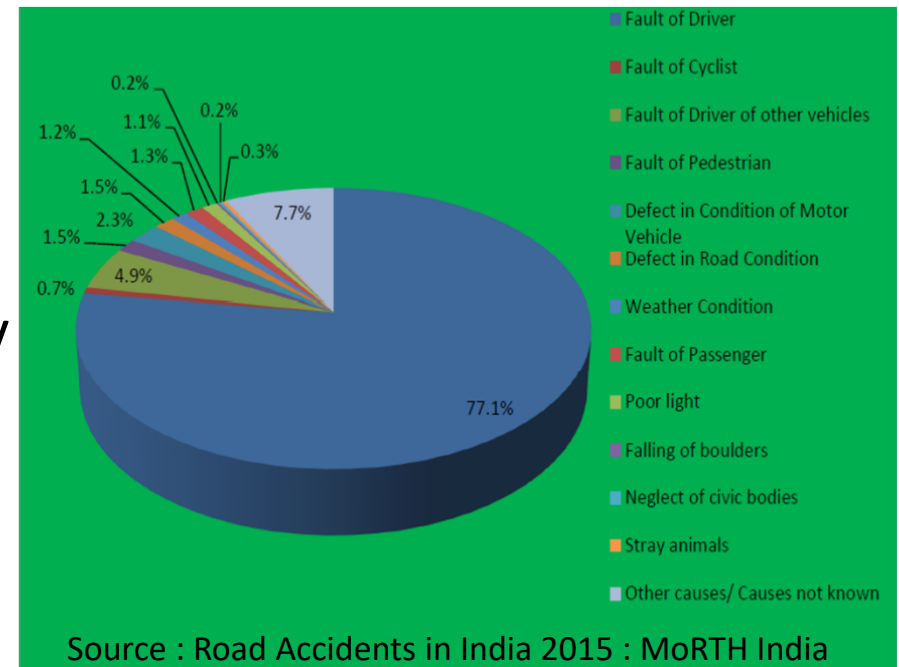
India Scenario

- Focus to reduce road accidents by 50%

- India ranks 3rd in terms of deaths due to road accidents
- There is one death every four minutes due to a road accident in India.

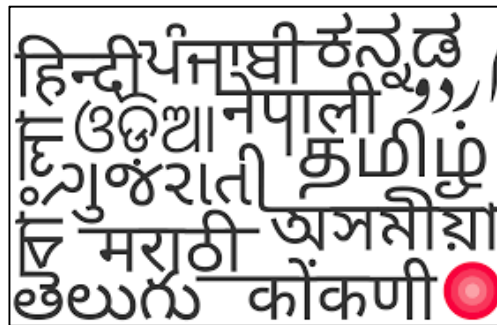
- Hike speed limits on Indian

Expressways for better road efficiency



India Specific Challenges - ADAS

- Infrastructure Constraints
- On road Behaviour (Drivers , Pedestrians)
- Diverse Geological , Environmental , Social Conditions



India Specific Challenges – BS VI



Increasing System Complexity viz. EAS, OBD etc.

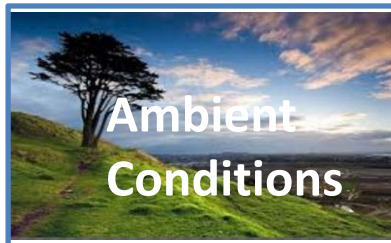
BS 4 to BS VI involves a lot of development, calibration, validation activity on the engine, after-treatment systems



Increasing development Costs



Development methodology must Change as BS 6 involves ISC on vehicles in addition to WHTC, WHSC, NTE cycles



Increasing Facility and Vehicle management complexity

Increase in complexity with the altitude Factor in BS 6



Shorter Development Times

EU took 11 years to migrate from EU 4 to EU 6

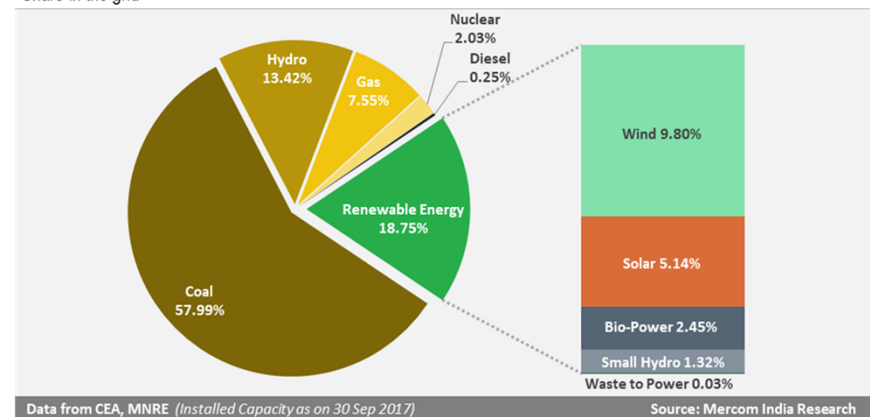
India Specific Challenges - Electrification

- Increasing Fuel Bill
- Increasing city pollution
- Paris Climate Change
- With 80 billion \$ investment, about 110 GW capacity could be extended every year
- 180 TWh electricity could be generated from that!

Auto Industry

	Today	2030 estimate
GDP	7.1%	\$350 billion
Oil Bill	\$80 billion	\$160 billion

Share in the grid



India has tremendous potential in Wind Power (sea sides), Solar (everywhere), Biomass

ARAI Program

Objective

Solutions for India Specific use cases
Testing and validation methods: How international solutions will work in India



Focus Areas

- Big Data & Analysis; MI
- Virtual and Experimental V&V Methodology

In collaboration with



Simulation : System Development

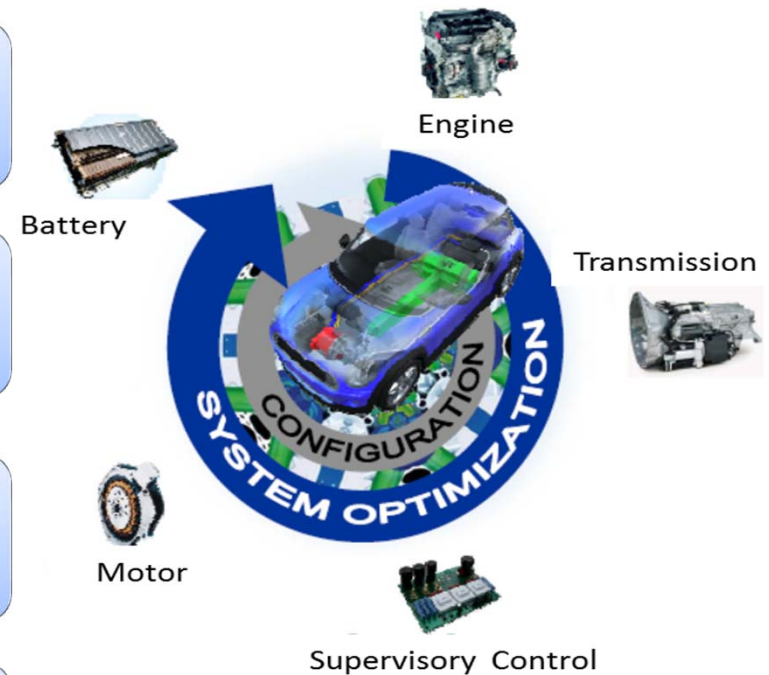
Involves multiple control systems

Multiple systems can be easily configured and tested in simulation, all with the same facility

Multiple configurations & iterations possible in less time

Multiple configurations and test cases possible which may be difficult with conventional system

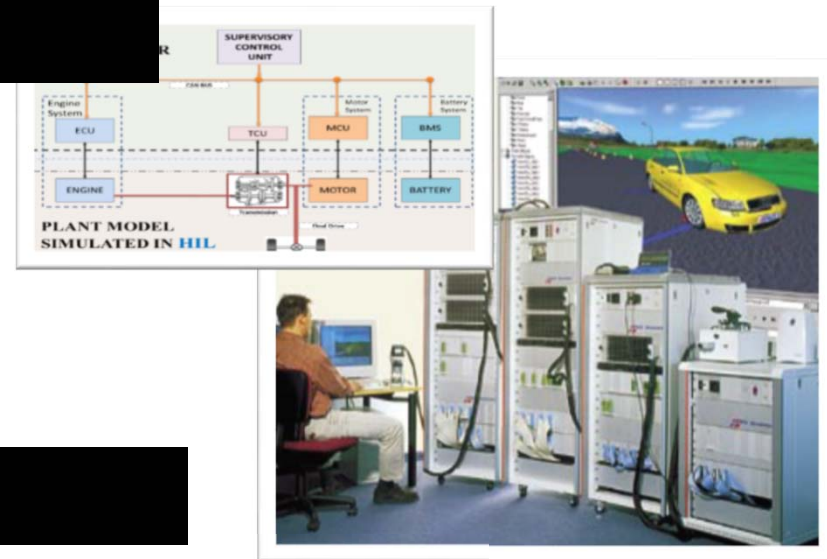
saves time, effort & money



Technology Areas

Electric/ Hybrid Technology

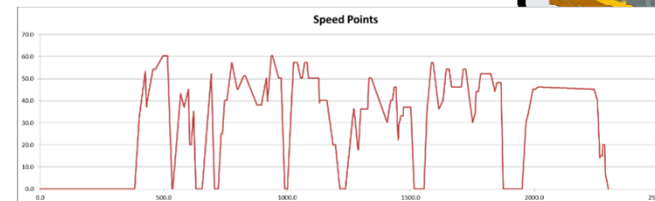
- Intelligent Vehicle Control Unit
- Multi ECU Simulation at HIL level



BMS Development

- SOC – (State of Charge)
- SOH – (State of Health)
- SOS – (State of Safety)

- Environmental Challenges
 - Temperature
 - Vibration
 - Moisture & Humidity

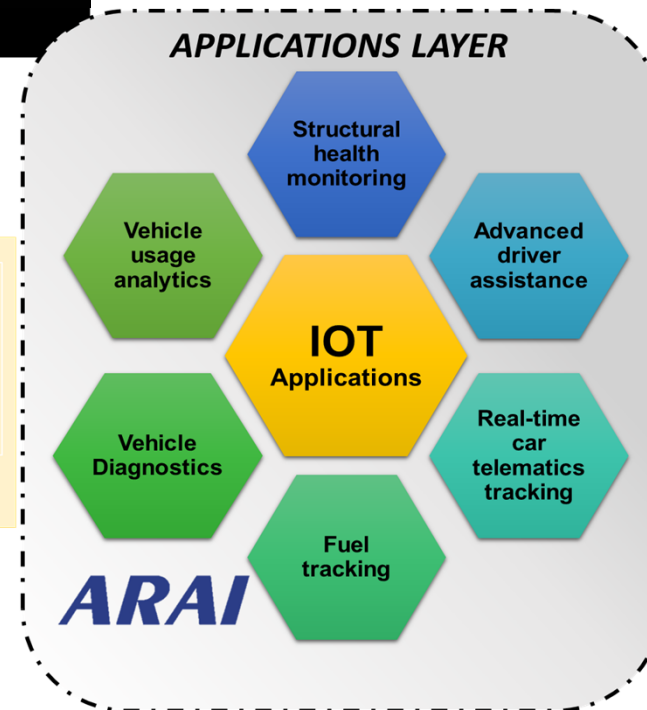
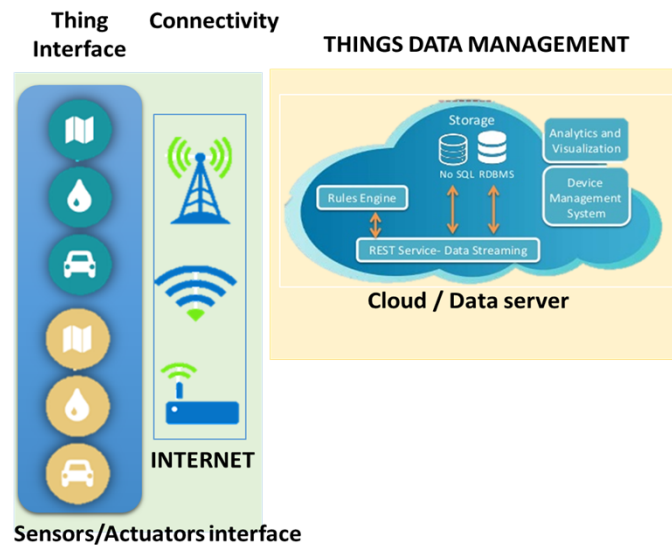


Technology Areas

Adaptronics

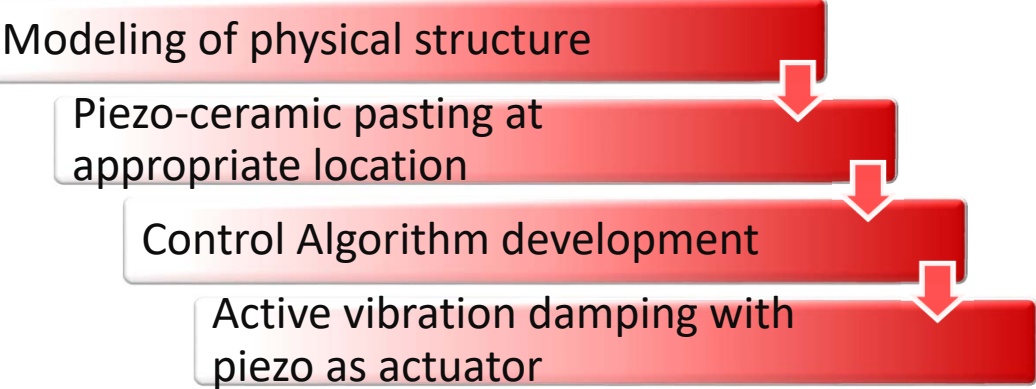
- **Structural Health Monitoring**
 - Indirect ,autonomous damage detection at load –bearing, operating structure using sensor

IoT

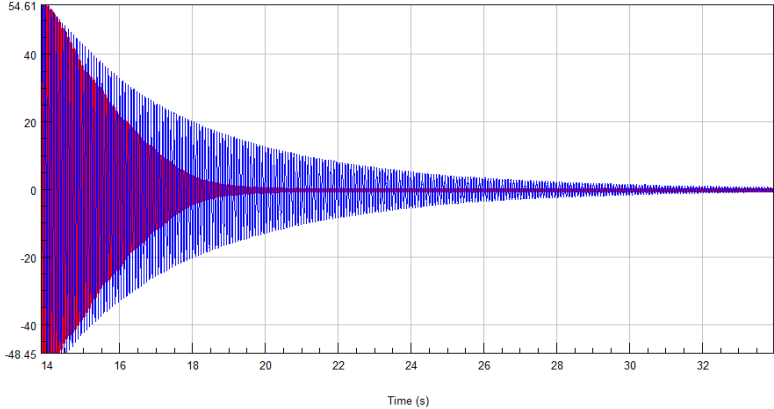


Technology Areas

SMART STRUCTURES APPLICATIONS – ACTIVE VIBRATION DAMPING

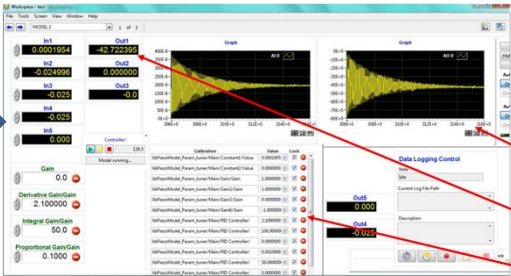
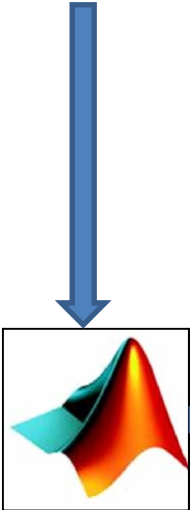


Cantilever Beam Response



— Response with Piezo Acting

— Passive response



Output with Piezo Acting

Output Displays

Parameters to control



Thank you!