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ARAI
Progress through Research

POWERTRAIN DESIGN

DESIGN I SIMULATION I DEVELOPMENT



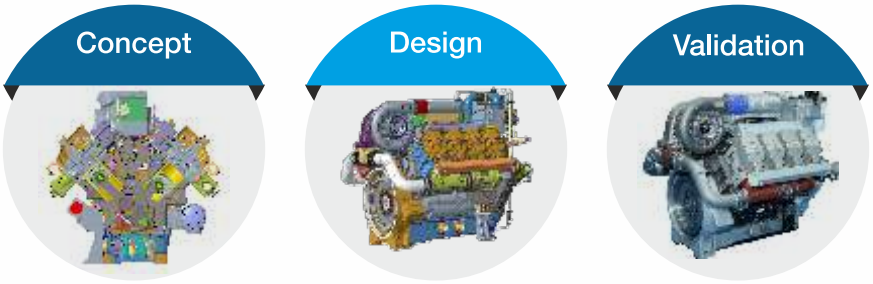






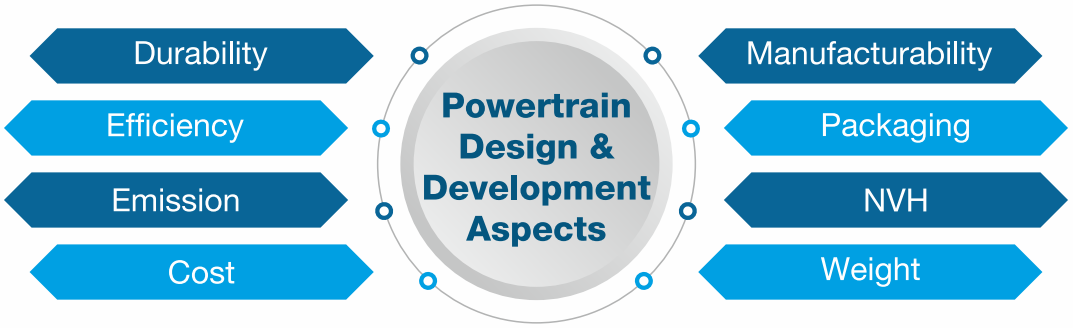
THE AUTOMOTIVE RESEARCH ASSOCIATION OF INDIA

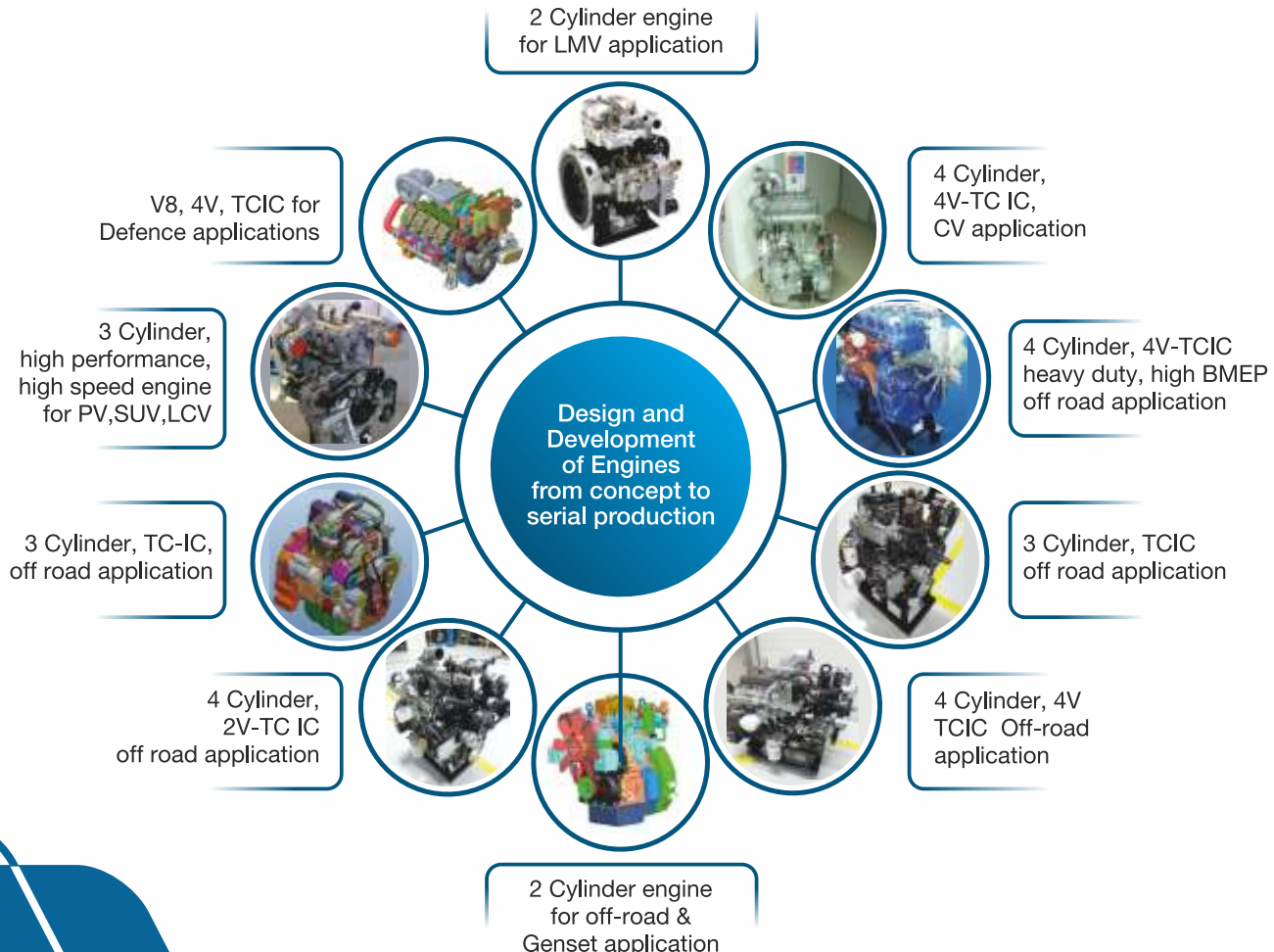
POWERTRAIN DESIGN (PTD) division of ARAI is an advanced R&D centre for design and development of engines, transmissions and all kinds of axles including E-axles for PV/SCV/LCV/HCV . PTD is engaged in engine design from concept to prototype till serial production support for HCVs, LCVs, PVs, Utility Vehicles, Tractors, gensets, 2 & 3 wheelers, Defence & Power applications for meeting respective emissions norms, durablity & NVH requirments On similar lines PTD have Competency to design all kinds of transmissions , axles, hybrid EV Powertrains, E-axles for PV, SCV, LCV, HCV & Hydrogen PEM Fuel cell electric powertrains



Service Areas

- Engine design from concept to prototype till serial production for all kinds of mobility & power generation applications
- Design of all kinds of transmission systems from concept to prototype till serial production for 2W, 3W, PV, SCV, LCV, HCV application
- Design upgradation of powertrain systems & components (engine, transmission, driveline)
- Design Vetting and feasibility analysis, Benchmarking, CAD, FEA, CFD of engine, transmission & axle systems & components
- Support for supply chain creation & Prototype development
- Design & Development of electric axles for PV, SCV, LCV & HCV applications
- Design & Development of powertrains for HEV, FCEV applications
- Design & Development of Hydrostatic transmissions
- Intake and Exhaust Port development

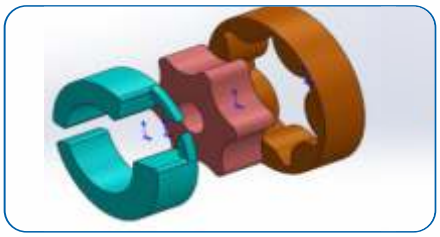
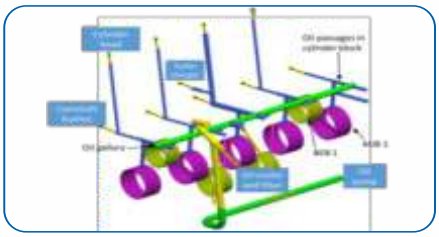
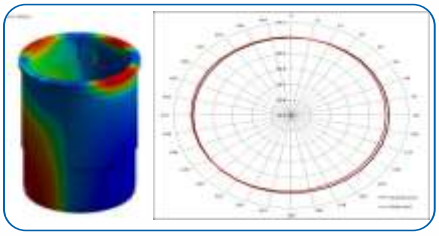
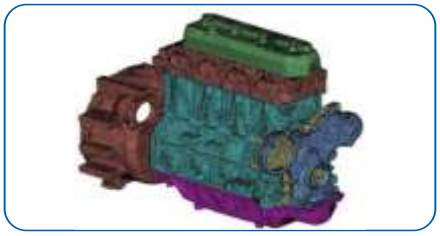
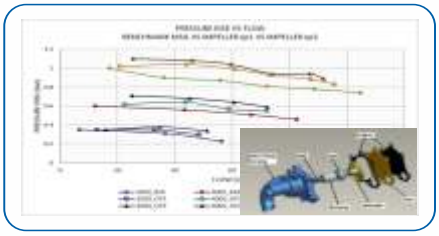


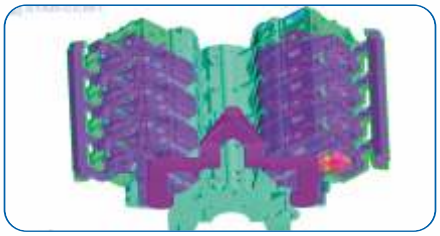


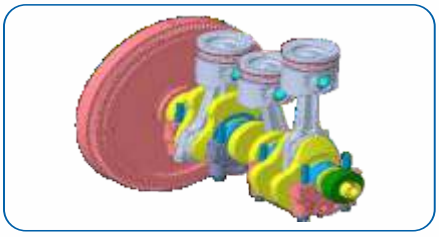
DESIGN/ANALYSIS OF SYSTEMS / COMPONENTS OF ENGINE

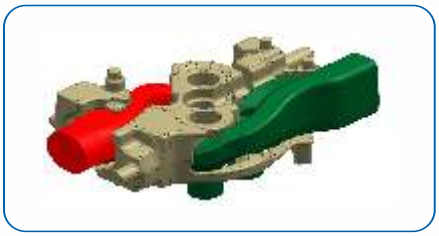
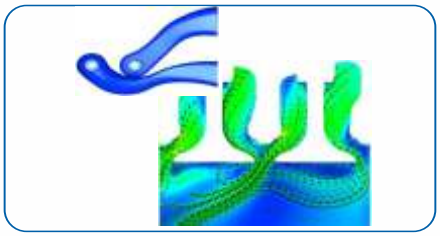
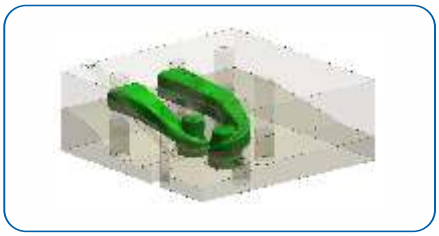
- Cylinder head, Engine block, Piston & Ring pack, Connecting rods, Crank Shaft, Bearing, Damper Pulley, Flywheel, Oil Pump, Water Pump, Camshaft, Torsional Vibration, Rubber / Viscous Damper, Cylinder Head, Gasket & Bolts.
- Valvetrain system, Balancer shaft systems, Lubrication & Cooling System, FEAD & Geartrains, OCV & CCV System, Intake & Exhaust System.
- Kinematic & Dynamic analysis of valvetrain,1D analysis of lubrication system.
- CAD, FEA, CFD analysis of Engine system & components.
- Structural dynamics of Engine systems & components.

Structural dynamics of Engine systems & components.





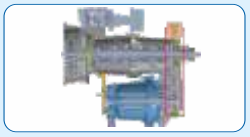
Design & Development of Transmission / Axles from concept till serial production

- Transmission design for passenger vehicle, commercial vehicle, off-highway and Electric Vehicles
- Live axles including LSD
- Differential gear box
- Planetary gear box
- Analysis for gear whine, rattle, efficiency
- Transmission NVH
- Transmission error analysis & improvements
- Synchronizer sizing
- MBD for shift quality improvements
- Design and development of AMT controller
- Design and development of hydrostatic transmission
- Design and dev. of hydraulic lift and TPL for tractor applications


Design & analysis of 6 speed gearbox


Design & development of front axle for all wheel drive tractor

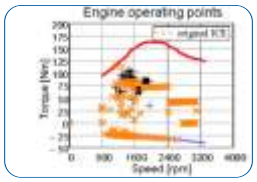

Hybrid Electric Retrofit Gearbox

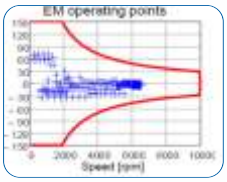

Design & development of 7 speed AMT for P3 HEV architecture

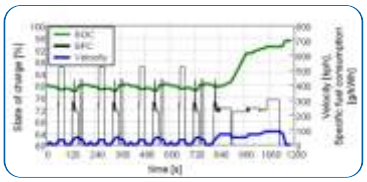
Design & Development of Advanced Powertrains

(HYBRID ELECTRIC VEHICLES / FUEL CELL VEHICLES / E-AXLES FOR-SCV, LCV, HCV AND PV)

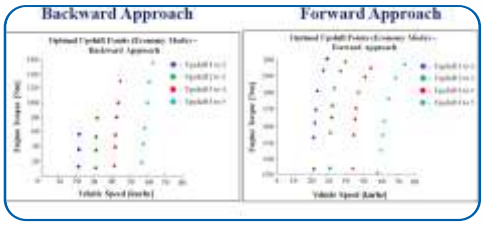
- AMT / DCT / CVT
- Layouting / Architecture & Configuration finalistion for full parallel, mild, series hybrid Evs, Hydrogen fuel cell electric vehicles
- Supervisory controller development for HEV operations
- Supervisory controller development for FCEV operations
- Conversion of EV to FCEV- Sizing & selection of hydrogen PEM /SOFC Stack & balance of plant components
- Thermal / Coolant management of Fuel cell engine
- Packaging and integration of fuel cell engine & hydrogen storage system
- Design and development of E-axles (SCV, LCV, HCV & PV)
- 2 Speed AMT based transmissions for electric vehicles

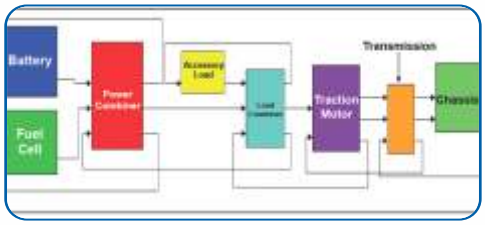


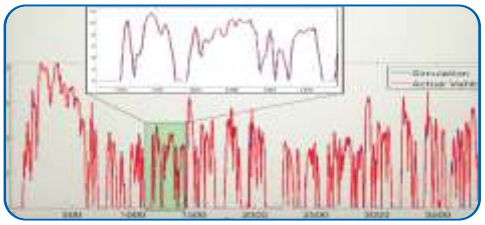



Development of P3 Type Strong HEV Powertrain using 7 Speed AMT










Development of shift maps for AMT, E Axle & Hydrogen PEM Fuel Cell Based Powertrains for PV & CV Applications

WHY ARAI'S POWERTRAIN DESIGN?

- PTD has over Three Decades of experience in powertrain design & development domain
- Has worked closely with almost all Indian as well as several overseas OE and component manufacturers
- Extensive available database helps in faster design solutions
- One stop solution for all engineering activities till production validation and support for SOP

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The Automotive Research Association of India
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