4.5 Months COURSEWORK for Comprehensive Competency & Skill Development on

Engine Performance Simulation in GT-POWER

Case Study

Practice

Access to Live Videos

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IST

IST Pvt Ltd

**EV, HEV & Engine Development
Staff Augmentation
Corporate Training**

For registration, please contact us:

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- Contact No.: **+91-9763909935**

Agenda Overview

This training module is designed for those individual engineers who are interested to develop comprehensive competency & skill in engine performance simulation using 1D simulation GT-POWER software.

Participants to go through technological and simulation aspects of the domain with lots of case studies and practices
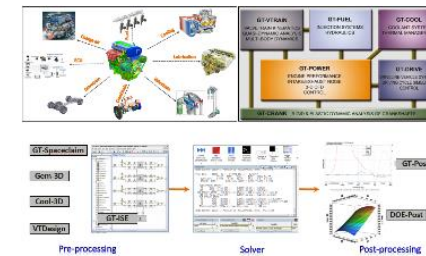
❏ **Engine performance theory**
  ✓ Engine development strategy and process
  ✓ Engine and its performance characteristics
  ✓ Engine air handling system
  ✓ Fuel injection, combustion, emissions
  ✓ Emissions control technologies

❏ **Why system level modeling and simulation**
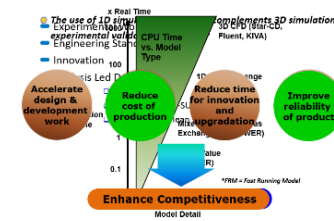
❏ **Introduction to GT-POWER**

❏ **Bridging real engine with GT-POWER model**

❏ **Engine model building**
  ✓ Data required to build and calibrate engine model
  ✓ Modeling of each component of an ICE including flow circuit, airfilter, turbocharger, heat exchanger, EGR system, manifold, port, valve, fuel injection system, cylinder, cranktrain, controller, and exhaust system devices from CAD and/or drawing in GEM-3D & GT-POWER
  ✓ Subassemblies - Internal, external, and encryption
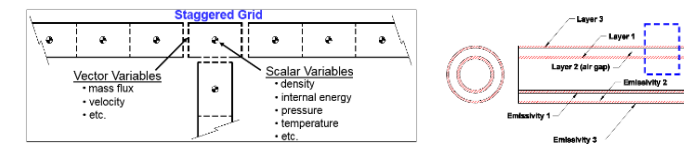 ✓ Model setup - Initialization, parameter sweeps, convergence, run setup, case setup
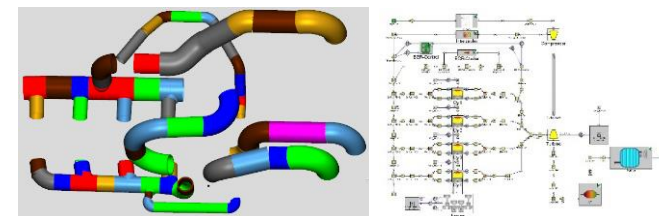
❏ **Burn rate calculation from cylinder pressure**
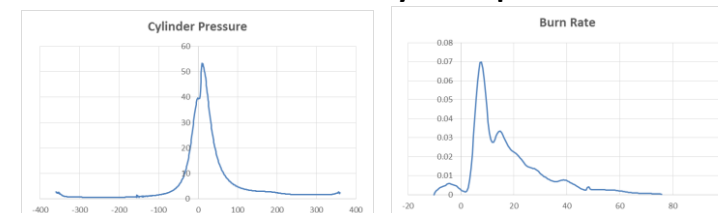
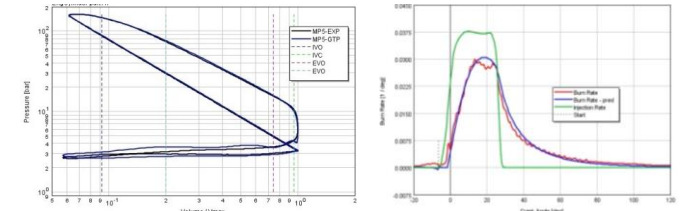❏ **Solution method**
  ✓ How closely the engine physical phenomenon are captured in GT-POWER
  ✓ Discretization, implicit vs. explicit
  ✓ Flow pressure loss, heat transfer, combustion & emissions

❏ **Engine model calibration**
  ✓ Detailed about calibration parameters
  ✓ Matching engine performance parameters
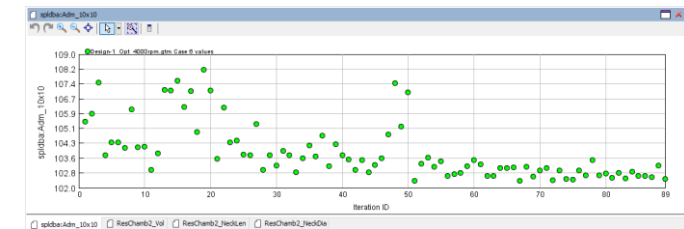 ✓ Matching engine performance plots

❏ **Post processing of simulation results in GT-POST**
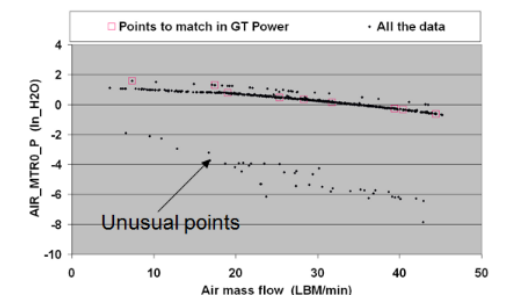 ✓ RLT variables, plots, comparison, table, contour, animation, math operation, data extraction, etc

❏ **Direct optimization techniques**
  ✓ Optimization of engine performance parameters with multiple independent variables & constraints
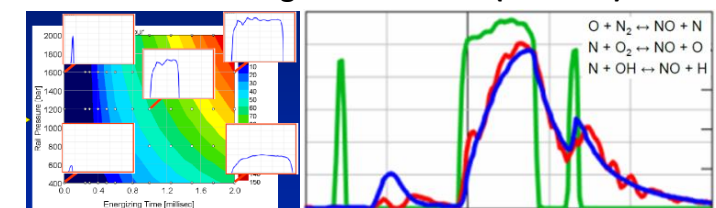

❏ **Measured data quality check**

❏ **Predictive diesel engine calibration (DI-Pulse)**

Trainer

❏ Over 19 years of industrial experience in diesel, gasoline, gas engines; HEV & EV; and aircraft engines
❏ 1D simulation domain – engine performance, cooling, HVAC, HEV & EV drivetrain, battery, lubrication, acoustics, hydraulics, cranktrain, and valvetrain
❏ Worked with GE, Cummins, ESI, MTU (Rolls-Royce), IST
❏ Conducting training for 10 years
❏ GT-SUITE user for 14 years
❏ M.Tech. from IIT Kharagpur

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Case Study

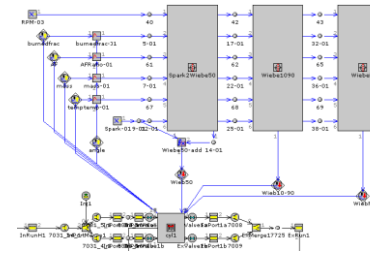Practice

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❑ **Semi-predictive combustion model**

❑ **Predictive SI engine calibration (SITurb)**

Entrainment
$$\frac{dM_e}{dt} = \rho_u A_f (S_L + S_T) \qquad S_T = C_s u' \left(1 - \frac{1}{1 + C_K (R_f / L_t)^2}\right)$$

Burn-up
$$\frac{dM_b}{dt} = \frac{M_e - M_b}{\tau} \qquad \tau = \frac{C_t \lambda}{S_L}$$
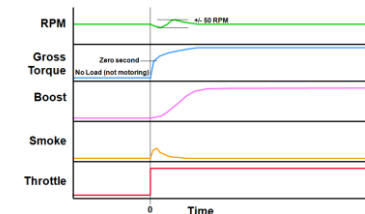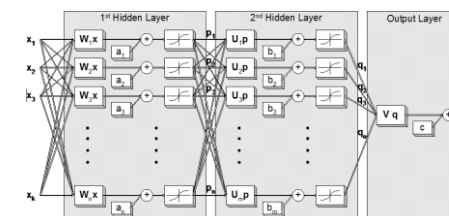
❑ **DOE optimization for engine performance parameter**

❑ **Use of PID and model based controller**
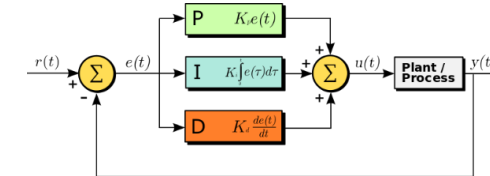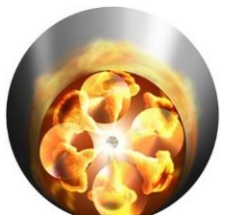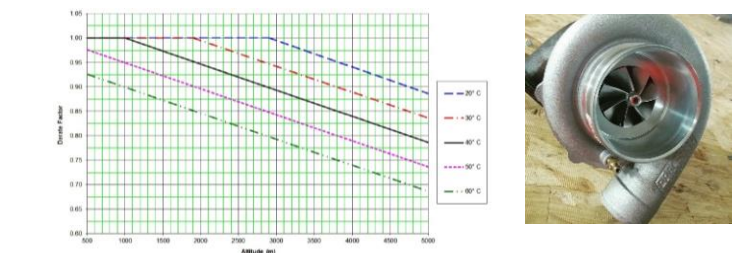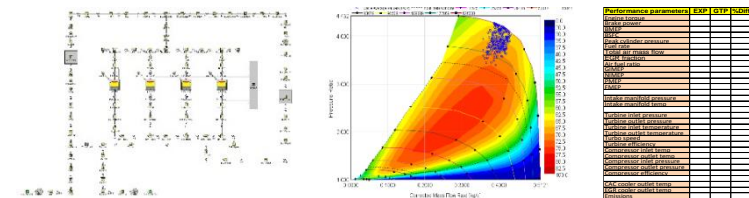
❑ **Transient simulation**

❑ **Neural network method**

❑ **Fast running model (FRM) & MVEM preparation**
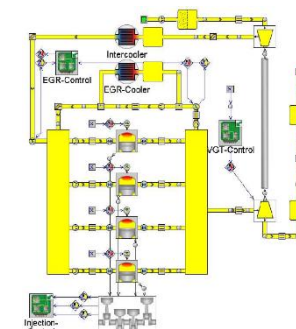
❑ **Case study of industrial projects**
  ✓ Model build of single cylinder & multi-cylinder turbocharged
  ✓ Calibration of single & multi-cylinder engines using prediction, semi-predictive & non-predictive combustion models
  ✓ Impact of various operating and design variables
  ✓ Direct & DOE optimization
  ✓ Power upgrade
  ✓ Power deration, altitude study
  ✓ Turbocharger selection
  ✓ Camshaft optimization
  ✓ Engine emissions optimization
  ✓ BSFC & volumetric efficiency optimization

Trainer

❑ Over 19 years of industrial experience in diesel, gasoline, gas engines; HEV & EV; and aircraft engines
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