

Introduction to Automotive Engineering

Introduction to Automotive Engineering Problem Solving

Course?level overview – concise, organized, and ready for study or quick reference.

1. Why Problem Solving Matters in Automotive Engineering

Aspect	Reason	Example
Safety	Faults can endanger occupants and other road users.	Brake?by?wire failure analysis.
Performance	Optimizing power, handling, fuel economy.	Reducing engine friction losses.
Reliability & Durability	Reduces warranty costs, improves brand reputation.	Predicting fatigue life of suspension components.
Regulatory Compliance	Emissions, noise, crash standards must be met.	Meeting Euro?6d emission limits.
Innovation	Solving new challenges enables breakthrough tech.	Integrating electric?drive power?train with existing platforms.

2. Structured Problem?Solving Process

Step	Goal	Key Activities	Typical Tools
1. Define the Problem	Capture <i>what</i> is wrong, <i>where</i> , and <i>when</i> .	• Write a clear problem statement. • Gather initial data (symptoms, logs). • Identify stakeholders.	Word processors, issue?tracking systems (JIRA, Redmine).
2. Collect & Analyze Data	Quantify the issue and locate root causes.	• Instrumentation (sensors, OBD data). • Statistical analysis (mean, variance). • Compare against baseline.	MATLAB, Python (pandas, NumPy), CAN?bus analyzers.

Introduction to Automotive Engineering

Step	Goal	Key Activities	Typical Tools
Problem Solving			
3. Generate Hypotheses	Propose plausible explanations.	cross-functional team. • Use “5 Whys” or fishbone diagram. • Controlled bench tests.	Miro, Lucidchart, hand-drawn diagrams.
4. Test & Validate	Confirm or reject hypotheses.	• Vehicle-level experiments. • Simulation runs.	CAE tools (ANSYS, AVL Cruise), test rigs, dyno.
5. Identify Root Cause	Pinpoint the fundamental source.	• Fault tree analysis (FTA). • Failure mode & effects analysis (FMEA). • Redesign components.	Reliability-centered software, FaultTree+, ReliaSoft.
6. Develop Solutions	Design corrective actions.	• Update software/ECU maps. • Process changes (manufacturing, QA). • Prototype build.	CAD (CATIA, SolidWorks), ECU calibration tools (ETAS INCA).
7. Implement & Verify	Apply solution and confirm effectiveness.	• Validation testing (durability, emissions). • Field trials. • Update engineering change orders (ECO).	Test tracks, on-road fleet monitoring.
8. Document & Communicate	Record lessons learned and close the loop.	• Publish technical reports. • Train service personnel.	PLM systems (Siemens Teamcenter), knowledge bases.

The cycle is iterative—new data may trigger earlier steps again.

3. Core Technical Areas Frequently Involved

Introduction to Automotive Engineering

Domain	Typical Problems	Representative Methods
Powertrain	Combustion instability, torque ripple, thermal overload.	Flow of intake/exhaust, engine mapping, thermodynamic cycle analysis.
Chassis & Suspension	Noise?vibration?harshness (NVH), ride comfort, handling imbalance.	Modal testing, multi?body dynamics