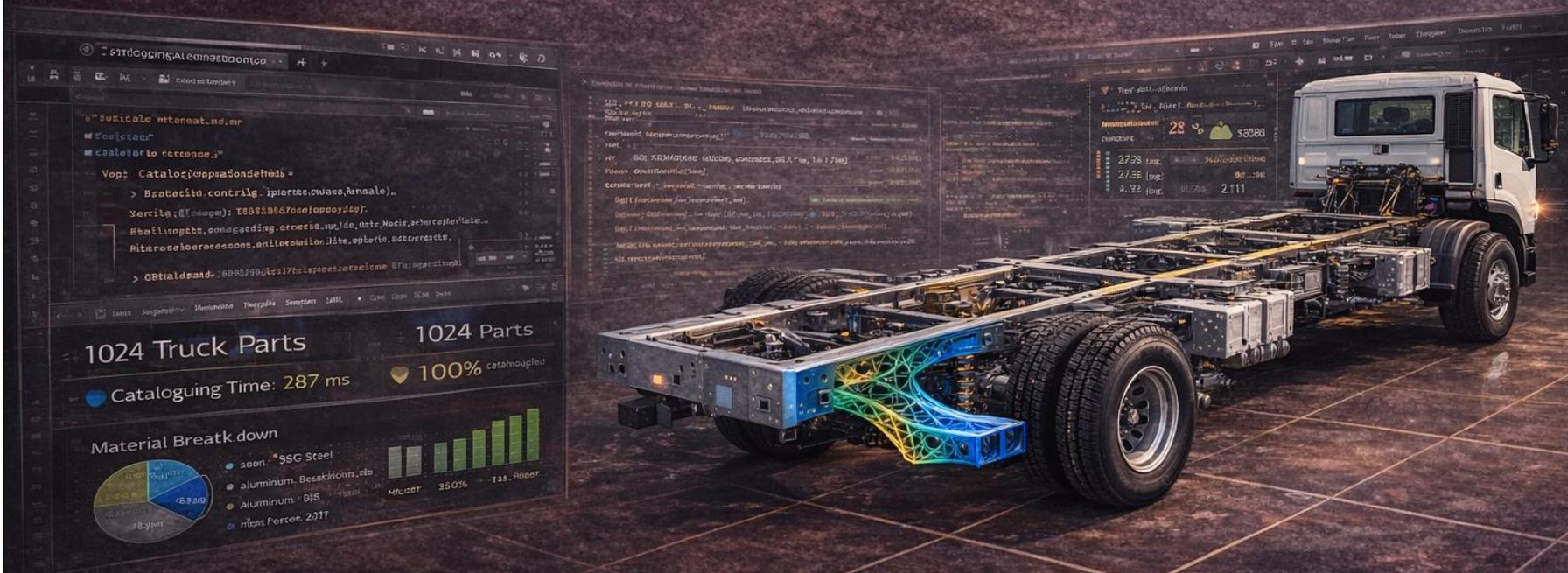


# Software Automation Portfolio

Rishi Oberoi

QA Engineering for CAD Automation, Truck Chassis Validation, and FEA-Driven Optimization



Testing complex engineering software at the intersection of C++, Python, FEA, and truck chassis automation



# Software Automation Portfolio

 Python FEA Validation + Chassis Component Optimization

## Software Automation Portfolio

SolidWorks · C++ DriveWorks · Python

Automating Truck Chassis Configuration, Validation & Optimization

-  Catalogued 1000+ parts (Aluminium + Light Steel)
-  Automated test scripts in C++ for part logic & assemblies
-  Python FEA 3D Topology Optimization + Weight Analysis
-  Regression suites & API validation for release reliability

1 test\_chassis\_config.cpp

```
1 TEST(Chassis, ValidateAssembly) {  
2     ChassisConfig cfg = loadConfig("TRK-560");  
3     auto result = runDriveWorks(cfg);  
4     ASSERT_TRUE(result.isValid());  
5     log("Weight: " + to_string(result.mass) + " kg");  
6 }
```

### Test Results

 1024 / 1024 Tests Passed

Regression Coverage

 94.7%



### Python - FEA Topology Optimization

```
density = optimize_topology(model, vol=0.67)  
mass = calculate_mass(density) # 132.48 kg
```



Stress (MPa)



# Software Automation Portfolio

## Python FEA Validation + Chassis Component Optimization

Python FEA Validation

```
1 import numpy as np
2 from fea import prepare_model, run_optimization
3 # Prepare FEA Model
4 density = 1.45 # g/cm³
5 yield_strength = 300 * MPa
6 fea_model = prepare_model(part)
7 # Run Optimization
8 optimized_part, mass, stress =
9 run_optimization(fea_model)
10 # Log Optimization Results
11 print(f"Weight reduction: {weight_reduction..21}")
12 print(f"Max stress: np.max(stress.21" MPa)")
13 print(f" Safety factor: safety_factor.21")
14 # Log Optimization Results
14 print(f"Weight reduction: {weight_reduction..21}")
15 print(f"Max stress: np.max_stress.21" MPa)")
16 print(f" Safety factor: safety_factor.21")
```

- Weight reduction: 18.62 %
- Max stress = 142.10 MPa
- Safety factor = 2.11



Python - FEA Topology Optimization

# Software Automation Portfolio

## Python FEA Stress Analysis & Validation of Truck Chassis Components

### Python FEA Validation

```
1 import numpy as np
2 import fea
3 # Prepare Stress Analysis Model
4 load driveWorks,truck_chassis,mesh/elements
5 material = rondes = 250 * MPa
6 force_vector = np.array([0, 0, -3500, 0, 0, 0,]);
7 # Run FEA Analysis
8 fem_result, stress, displacement =
  fea.run_stress_analys(chassis_model,force_vector)
9 # Validation Checks
10 fem_result, stress, stress = max_stress_limit
11 validity -= text -fem_result - yaS')
12 # Test Validation Results
13 log("someg"Displacement" ~ + {displacement)
14 log("weight" ~ log ^i&isplacement];^ ~)
```

### Test Validation Results

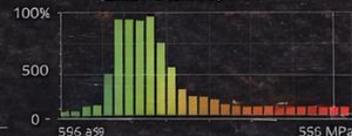
- ✓ Validation Status: PASSED
- ✓ Maximum Stress: 245 MPa
- ✓ Max Displacement: 9.42 mm
- ✓ Safety Factor: 1.02



### FEA Analysis Summary

- ✓ Validation Status: PASSED
- ✓ Maximum Stress: 245 MPa
- ✓ Max Displacement: 9.42 mm
- ✓ Safety Factor: 1.02

### Stress Distribution ~ Max Stress Limit (Limit = 245 MPa)



### ✓ Validity:

- ✓ Maximum Stress: 245 MPa
- ✓ Displacement: 9.42 mm
- ✓ Safety Factor: 1.02



# Software Automation Portfolio

 C++ DriveWorks – Cataloguing 1000+ Truck Parts

```
CataloguingAutomation.cpp x
File Edit Tools Help
1 #include <iostream>
2 #include <DriveWorkSAPI.h>
3
4 void CatalogueParts() {
5     for (auto& part : PartsDB) {
6         std::string material = part.GetMaterial();
7         double mass = CalculateMass(part);
8         Dimensions dims = part.GetDimensions();
9         int fatigueLife = AnalyzeFatigue(part);
10    }
11    SaveToDatabase(part.ID, material, mass, dims, fatigueLife);
12    std::chrono::milliseconds apiTime = GetAPIResponseTime(part.ID);
13    std::cout << "Catalogued Part: " << part.ID << " in "
14    << apiTime.count() << " ms\n";

```

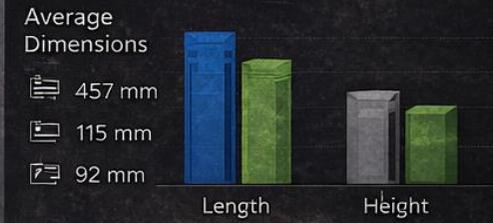
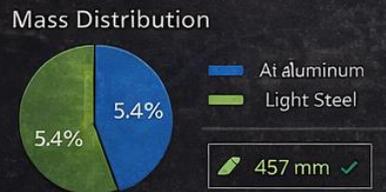
```
[INFO] Catalogued Part: 001235 - Material Aluminum - 1.276 kg - [274 ms]
[INFO] Catalogued Part: 001236 - Material Light Steel - 18.42 kg - [295 ms]
[INFO] Catalogued Part: 001237 - Material Aluminum - 8.55 kg - [261 ms]
[INFO] Catalogued Part: 001236 - Material Aluminum - 5.38 kg - [305 ms]
[INFO] Catalogued Part: 001238 - Material Light Steel - 24.16 kg - [288 ms]
```

**1024 Parts Catalogued** DriveWorks Automation

 287 ms Avg.  0 Cataloguing Errors  100% Catalogued

### Truck Parts Catalogue

PartID	Material	Mass (kg)	Dimensions	Fatigue Life	API Time	Status
001235	Aluminum	3.36 kg	239 x 179 x 322	6,000	274 ms	✓
001238	Light Steel	11.42 kg	548 x 179 x 330	55,000	295 ms	✓
001232	Aluminum	5.36 kg	579 x 179 x 222	16,000	261 ms	✓
001238	Aluminum	5.35 kg	239 x 179 x 222	28,000	305 ms	✓
001239	Light Steel	24.16 kg	355 x 179 x 223	40,000	288 ms	✓



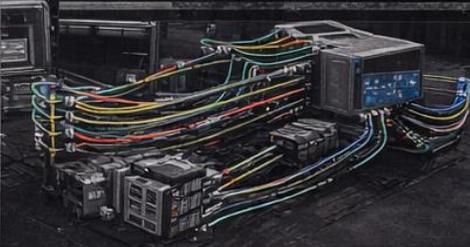
# Software Automation Portfolio

 C++ Automated Testing & Diagnostics for Cab Wiring Harnesses

```
File Edit Code View Help
WiringDiagnostics.cpp x Types.h ECU.h
File FN CataloguingAutomation.cpp
1 #include <DriveWorksAPI.h>
2 #include <vector>
3
4 void TestWiringHarness(WiringHarness& harness) {
5     for (circuits in wires {
6         voltage voltage = MeasureVoltage(wire);
7         current current = MeasureCurrent(wire);
8         Resistance reistance = MeasureResistance(wire);
9     }
10    // Run validation checks: {
11    if (ValidateVoltage(wire_voltage, check.if
12        ( CANSIGNAL canSignal = wire.getCANSIGNAL(); reistance <0.1.Ω )
13    }
14    } Record any faults found (numbers of detectedFaults vector: count< fault_id : mjr )=>
```

```
Console
[FAILED] Wire #67 Wire #07 -> Ground Short Detected [V=0.0 | I =-0.833A | Ω=0.1]
[FAILED] Wire #12 Wire #12 -> Signal Deviation: CAN CRC Error [V =2.97 | I =1.99A | Ω=66.8]
[FAILED] Wire #23 Wire #23 -> High Resistance: Connection Corrosion [V =11.8 | I:0.105A | Ω>100]
[PASSED] All Other Circuits Validated: 28/26 Circuits Passed [583 ms]
```

DriveWorks - WiringDiagnostics.cpp x



Wiring Diagnostics

Tests Run: 26	Faults Detected: 3
Validation Time: 583 ms	Moderate

Fault Analysis

- 07 Ground Short Detected: V=0.0|+0.833A
- 12 CAN CRC Error V=2.97 | 1.095A | Ω =66.8
- 23 Connection Corrosion V=11.8|10 | Ω =100

163 ms

Fault Breakdown

39%	39%	34%
23 Faults	3 Faults	33
Power	Signal	Ground

Wiring Schematic

19	10	9	7
Power	Signal	COfm	Ground

