Optimal calibrating of microprocessor control system of VAZ-2110 experimental engine with distributed injection

An example of using IOSO software for solution of real-life emission control problems in Russian car companies such as AvtoVAZ, ZMZ, UMZ and others. Specifically, effectiveness of the method of quick search for optimum adjustments of the automotive engine control system by utilizing IOSO algorithm was demonstrated on a mathematical model for VAZ-2110 car engine. It allowed us to determine the solution of the optimization problem that enabled the search of air-fuel ratio, ignition timing and exhaust recirculation optimum bounded control. For each speed-load regime it was necessary to find the appropriate values of these three control parameters (air-fuel ratio, ignition timing and exhaust recirculation) that provide minimum fuel consumption (the optimization objective) at the limited (specified or constrained) emission levels of CO, NO and CH.

The engine was equipped with the MS which included the electronic system of the fuel supply with the feedback on the λ-probe, ignition timing control system, turbulent flow intensity control system (tampers in the inlet collector are dosing the quantity of the gang air through one of the two inlet dampers for each cylinder) and the system of the exhaust recirculation optimum control.

Slide 3 shows optimal calibration of a multiprocessor control system of UMZ experimental car engine to insure minimum over/undershoot of air-fuel ratio during acceleration and throttling. Engine's fuel economy was improved by up to 6%. Optimal calibration of electronic fuel supply and ignition control system was carried out.

Publications:

1.Dulikravich,G.S., Egorov,I.N. "Calibration of Microprocessor Control Systems for Specified Levels of Engine Exhaust Toxicity",19th International JUMV Conference SCIENCE AND MOTOR VEHICLES 2003, Belgrade, May 26-28, 2003.

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Purpose:

To insure minimum overthrow of air-fuel ratio during acceleration and throttling processes

Problem features:

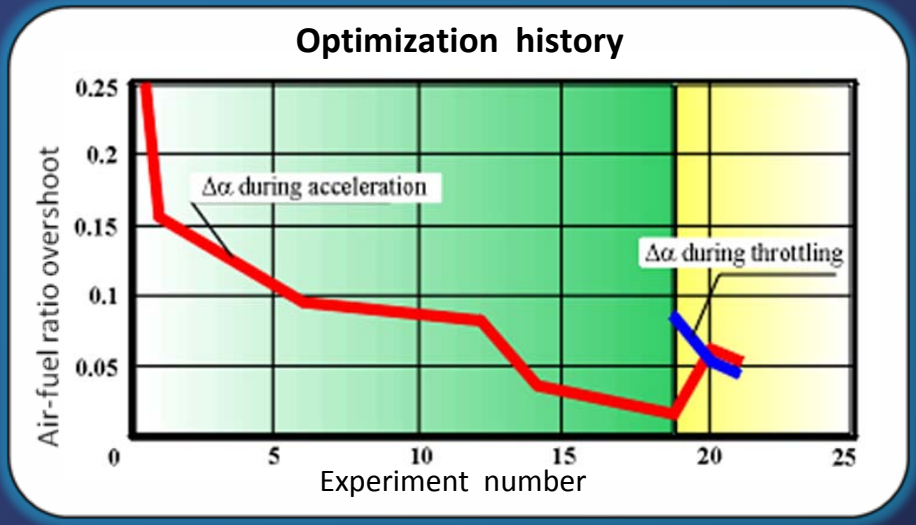
3 variables, 1 constraint

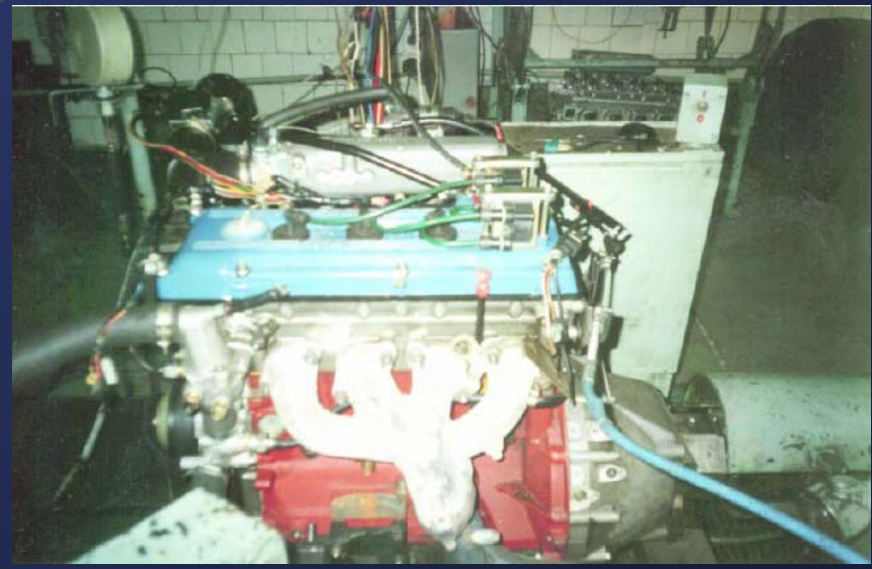
Problem peculiarities:

Minimization of α overthrow

I stage – for acceleration when of $\Delta\alpha$ throttling is being constrained (19 experiments)

II stage – for throttling when $\Delta\alpha$ of acceleration is being constrained (2 experiments)





This is a kind of application of the IOSO software and the experimental work. There is an experimental stand of AUTOVAZ car plant, Russia, where the calibration of microprocessor control system of engines is performed.

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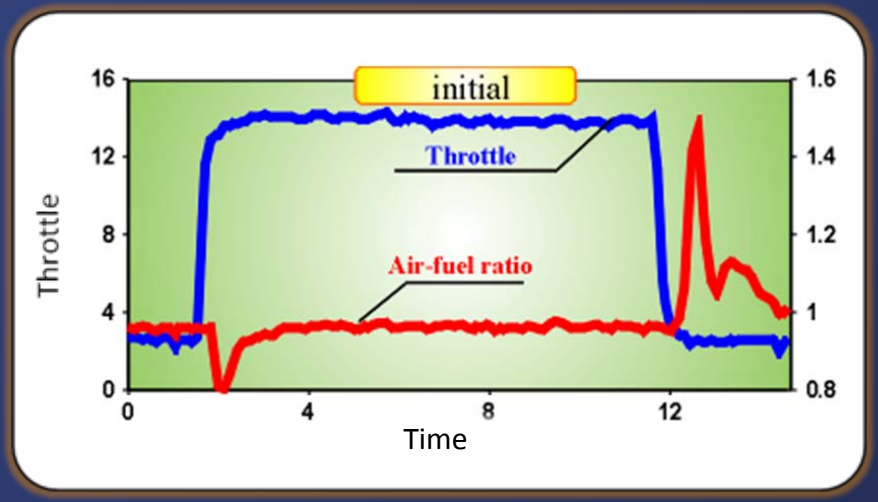
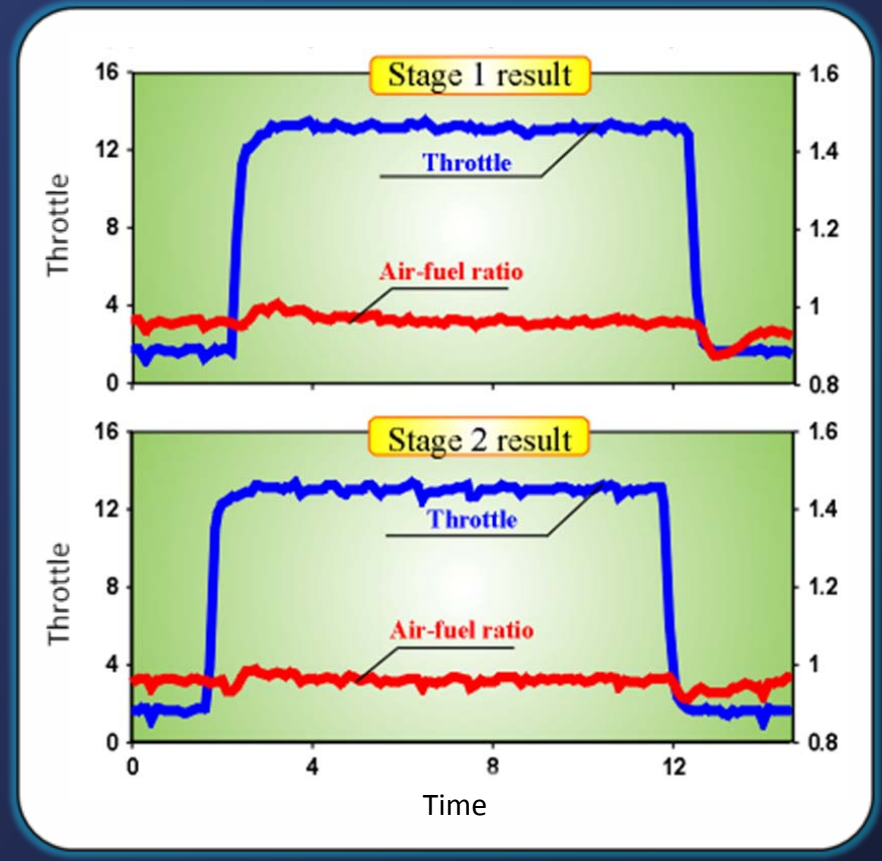
While accelerating and then dropping the throttle of the engine an alpha-parameter jump occurs. Alpha-parameter is the Air-fuel ratio that characterizes the pollution. To make this parameter stable during throttling, the microprocessor control system calibration is performed on the experimental stand. Alpha-parameter depends on many factors which engineers usually tune during calibration processes.



While without the use of the IOSO, an engineer should perform about 200 experiments to make the alpha-component stable, involving the IOSO makes it possible to perform only about 20 experiments, that is 10 times faster.



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