

## Predimot Predictive Control of Combustion Engines

In the project PREDIMOT, predictive techniques are applied to control the air path of internal combustion engines. Until now, the engine management is based on static maps, those tuning is expensive, time consuming and largely empirical. The goal of the research is to develop automatic tuning procedures based on predictive strategies for the synthesis of the control laws to minimize pollutant emissions and fuel consumption.

### Problem/needs addressed by the sub-project

New emission limits still force the automotive industry to improve combustion engines. This can be done by changes in the hardware (construction, catalysts, filters...) or by modifications in the software, especially the control strategy for injection and airpath. Commercial engine control units are still developed in a very heuristic way for the airpath and reach a huge and fault-prone complexity. To overcome those problems, modern control strategies like predictive control depict a promising alternative but needs experts on engine, control and software design.

(<http://predimot.jku.at/>)



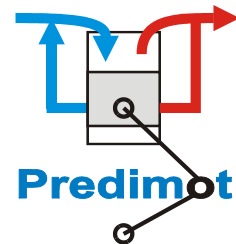
Left: Presentation at PREDIMOT meeting in Milan  
Right: PREDIMOT partners at a meeting in Linz

In particular view, industrial benefits for the interested companies TCG Unitech Systemtechnik GmbH, AVL List GmbH and Daimler Chrysler AG can be strategies for optimization based modelling and predictive control, hardware and software design for real time testing of engines.

### Statements and thoughts

**Peter Langthaler –  
Lead Participant Manager**

REGINS offers in the subproject PREDIMOT the opportunity of starting an academic network where especially regional companies get in close contact to universities and can take out know-how or ideas obtained in this programme. On the other hand, the universities can profit from practical expertise of companies.



### Objectives of the sub-project

The aim of the project is to develop basic methods and to test the possibility of using these optimization approaches for engine control on two important problems:

1. The control of variable-valve-timing and exhaust-gas-recirculation on a direct injection spark ignition engine
2. The control of turbocharged diesel engine with exhaust-gas-recirculation.

### REGINS project partner

REGINS (REGIONal standardised Interfaces for a better integration of regional SMEs in the European Economy) is an INTERREG III C Regional Framework Operation (RFO) that aims to support interregional cooperation projects (Sub-Projects) within the thematic priorities automotive, biotechnology and logistics within the participating partner regions Upper Austria, Stuttgart Region, Lombardy Region and West-Pannon.

## Summary/activities of the sub-project

The sub-project activities can be described by the scheme below:

- Mathematical modelling and analysis
- Development of plant simulators
- Model validation
- Control design with predictive techniques
- Implementation of the control schemes and analysis of results

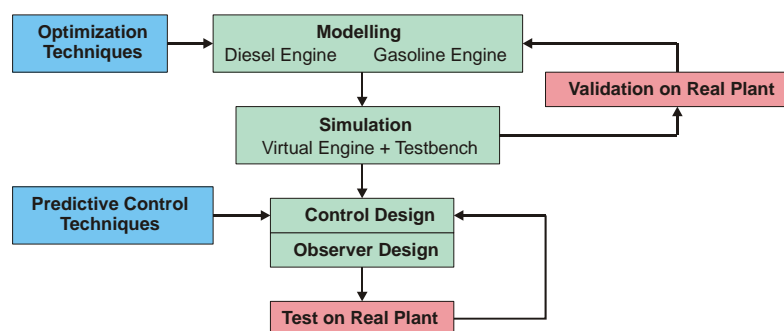
After summarizing the state of art in engine modelling, predictive control and optimization methods for fast processes, the mathematical models of diesel and gasoline engines (air path), dynamic simulators are developed. Then the models are validated by means of real data and provided to all the partners, who contribute the definition of a number of control schemes and in the development of predictive control strategies based on the driver's load request to enhance the engine performance in terms of fuel consumption, driveability and pollutant emissions.

## Contribution to strategic goals of REGINS

The PREDIMOT project enables a know-how transfer of complementary know-how for automotive applications. This network of expertise increases competitive capacity of the involved regions and is expected to provide ignition points for new projects. Meetings, a workshop and several short visits between the groups are planned, where experts of different engineer disciplines will exchange theoretical knowledge (by universities) and experimental knowledge (from industrial partners). The results of the workshops will be summarised and published with results from the project.

External experts and other possibly interested companies will be informed and invited to the final presentation. Furthermore an internet page (<http://predimot.jku.at>) was set up as information platform.

Meetings are regularly organised together with supporting companies which give their advice met problems in PREDIMOT. By this cooperation the academic know-how will be developed in accordance with industrial needs so that a later transfer to industry in the framework of further cooperation should be easily attended.



Scheme of Development Process

## Facts and figures

Name of the sub-project	<b>PREDIMOT – Predictive Control of Combustion Engines</b>	
Duration	May 2 <sup>nd</sup> 2005 – March 31 <sup>st</sup> 2006	<a href="http://predimot.jku.at">http://predimot.jku.at</a>
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