

FISITA World Automotive Congress 2016 HV SAE Switzerland

Richard Hutter, 31.03.2017

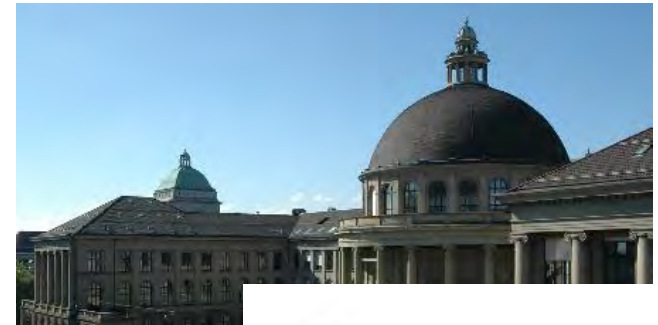


Outline

- Background
- The Travelling Fellowship Program
- FISITA World Automotive Congress in Busan
- Submission

Background

- PhD Candidate
 - Supervisor: Prof. Ch. Onder
- Submission
 - FISITA World Automototive Congress in Busan, South Korea
- Application for FISITA Travelling Fellowship Program through SAE Switzerland
 - Travel and accommodation covered by SAE Switzerland



F2016-ESVB-003

DIESEL MINIMAL COMBUSTION CONTROL WITH CONSTRAINTS IN A DIESEL-IGNITED GAS ENGINE

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KEYWORDS – diesel-ignited natural gas engine, dual-fuel engine, diesel minimal control, extremum seeking, feedback control

ABSTRACT

The diesel-ignited natural gas engine is a promising approach for the next generation of alternative fuel converters as it combines low CO₂ abatement cost with high thermal efficiency. Diesel is solely used as the engine's ignition source, while the amount of diesel injected is minimized using an extremum seeking method. The extremum seeking controller finds the optimal combination of injection timing and duration that fulfills the desired combustion phasing as well as minimizes the amount of diesel injected. In high load conditions, the amount of diesel required for ignition might turn out to be very small – even smaller than the minimal amount possible with the given injectors. This may result in deviations of the combustion phasing. An extended version of the diesel minimal control is presented that is capable of dealing with a constrained minimal injection duration. In the second part of the paper we investigated whether the diesel minimal strategy is also optimal in terms of fuel economy and emissions. Therefore we conducted an experimental sensitivity analysis of the injection timing.



Travelling Fellowship Program

“FISITA and KSAE offer young engineers and students under the age of 35 a once-in-a-lifetime opportunity to participate in the Travelling Fellowship Program combining cultural and technical visits across Korea”



South Korea – Introduction

- 1910 Annexed into Imperial Japan
- 1945 Devided after Japans Surrender
- 1950 Korean War
- 1953 «Micracle on the Han River»
Annual economy growth of 10% over 30 years

Today

- 51 million people
- 5th largest exporter
- Free trade agreements with 75% of the world economy
- 8th highest median household income
- Most innovative country (Bloomberg innovation index, 2017)
- 1st rank in 4G LTE coverage

South Korea – Automotive Industry

- 1962 Automobile Industry Promotion Policy
 - Kia Industry (Mazda)
 - Asia Motors (Fiat)
 - Hyundai Motor Company (Ford)
- 1994 Samsung (today Renault Samsung Motors)
- 2013 4.5 million units (production, 70% export)



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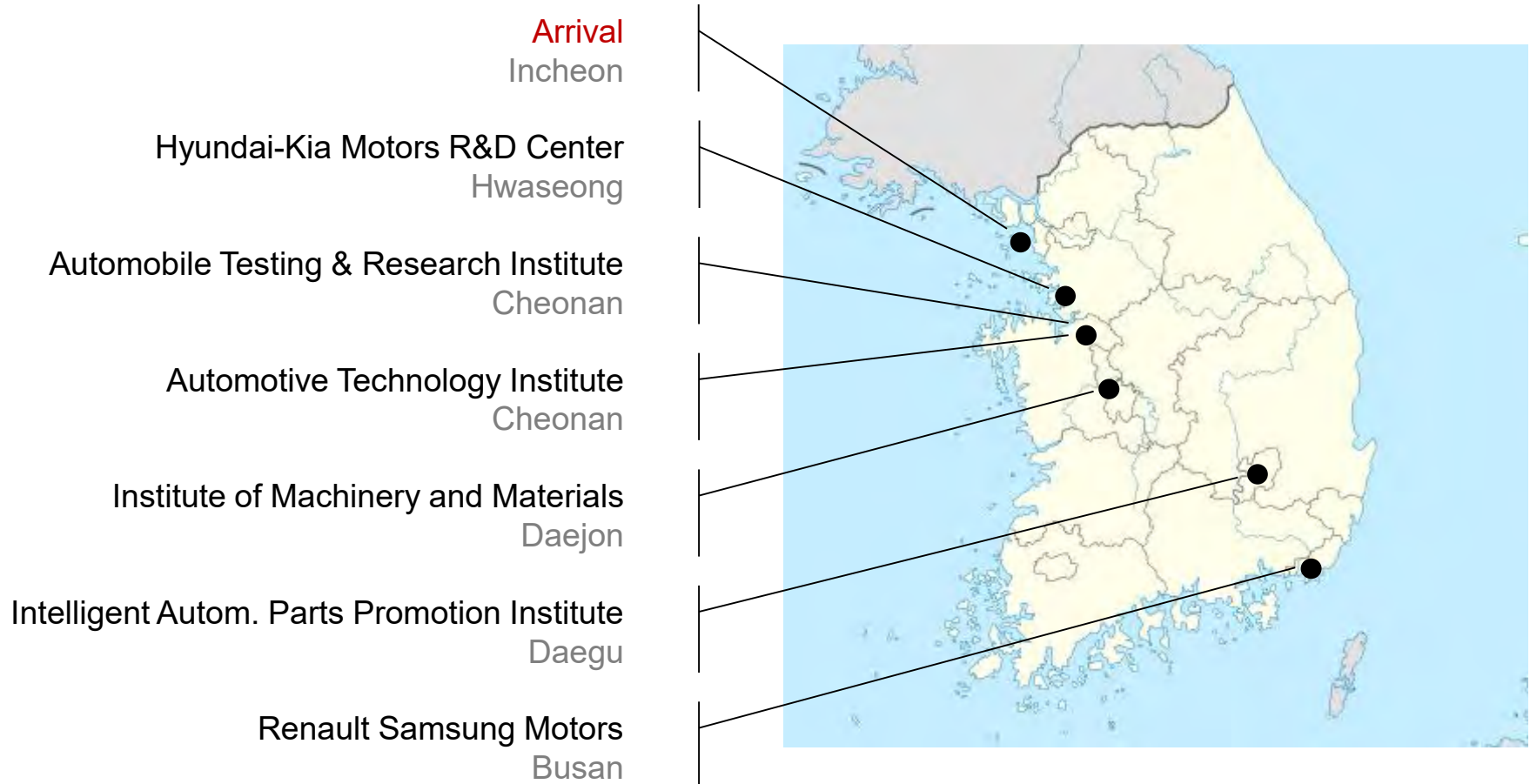


Pony



Genesis

Schedule 19.9 – 23.9



Travelling Fellowship Program



Technical Visits



Technical Visits



Temple Stay



FISITA World Automotive Congress

Busan Exhibition and Convention Center



Busan

2nd largest City (3.5 million)

5th busiest seaport

Congress

Technical Sessions (~90)

- Engine Systems
- Vehicle Electronics and Software
- Noise Vibrations and Harshness
- Vehicle Dynamics and Controls
- ...

Exekutive Tracks (~10)

Student Congress

Partners Forum + Exhibition

The Submission

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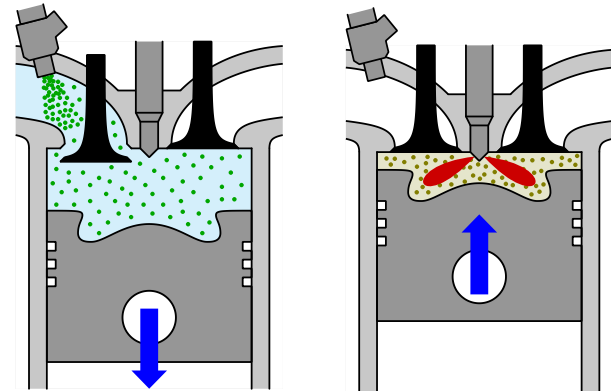
Diesel-ignited Gas Engine

Natural Gas - primary fuel

Diesel - ignition source

- ✓ Extend ignition boundary (lean burn)
- ✓ Minor modifications to diesel engine

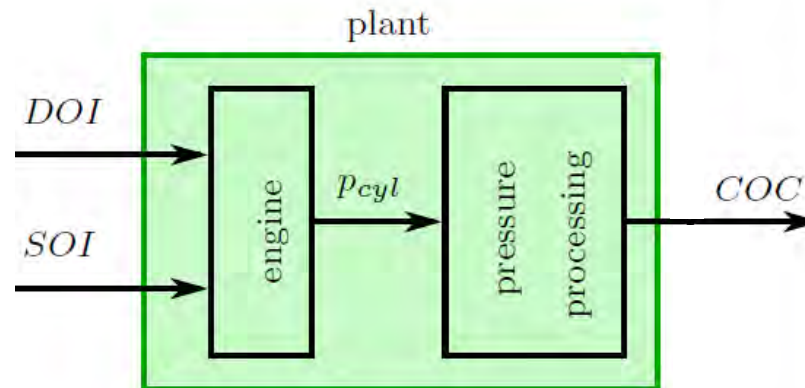
Goal: Minimize diesel consumption (CO_2)



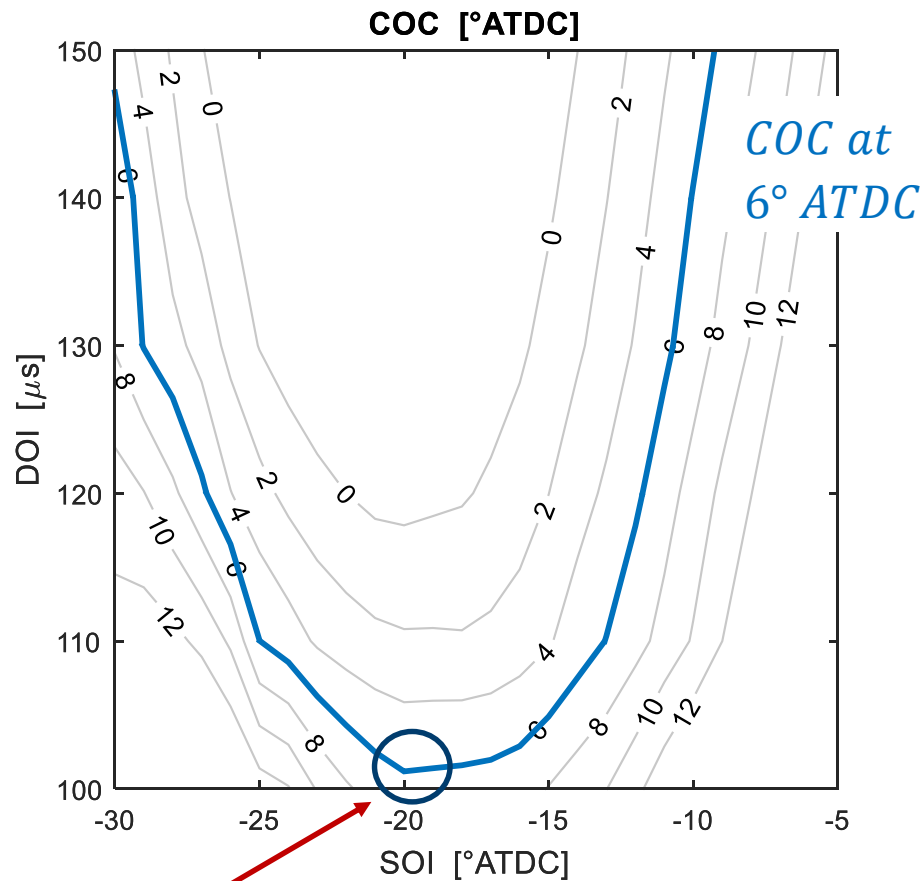
Diesel Injection - System Description

DOI Duration of injection
SOI Start of injection

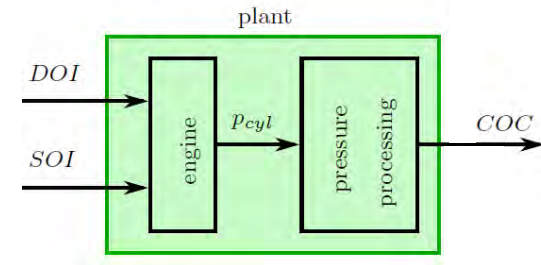
COC Center of combustion



Diesel Injection - Input/Output



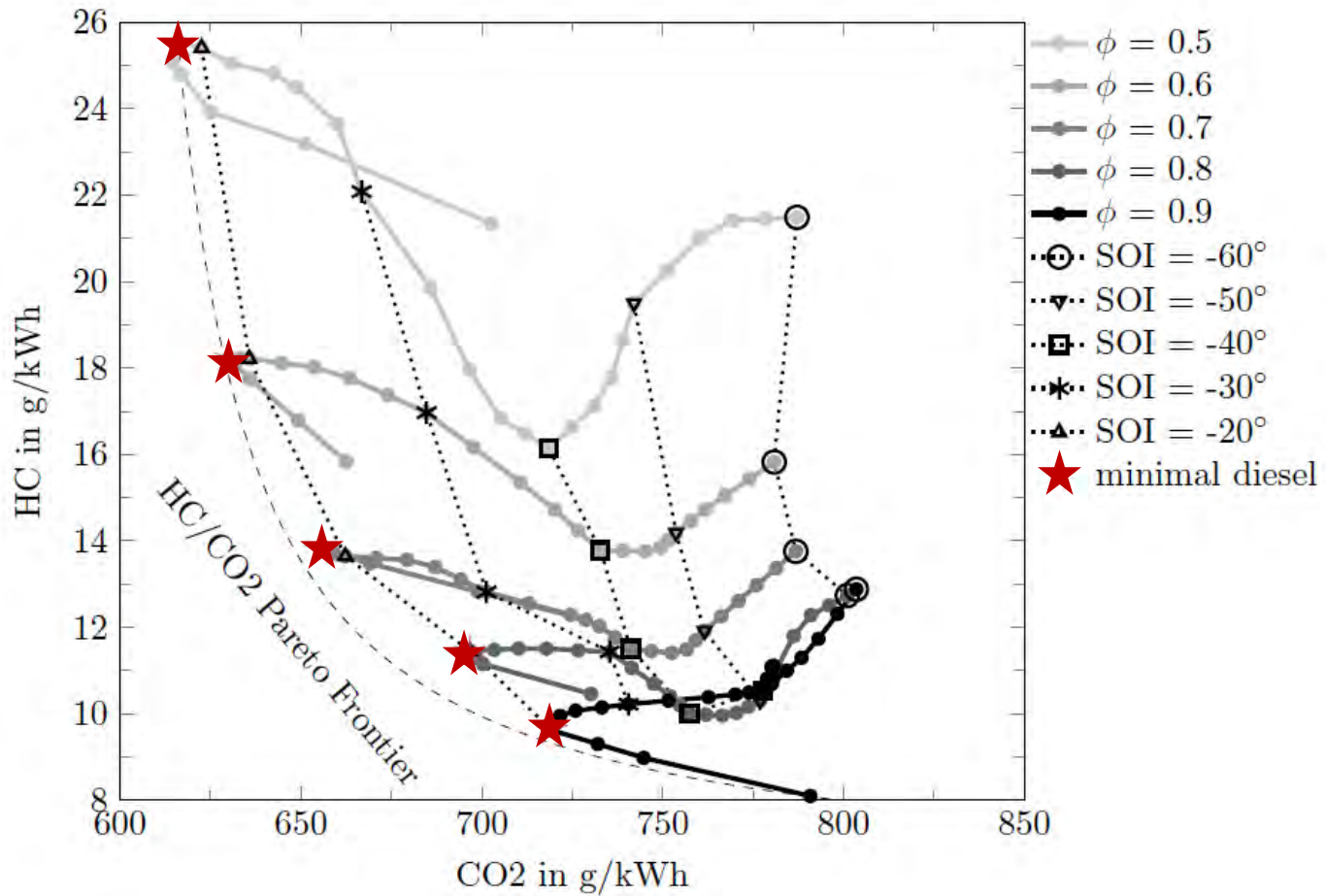
minimal diesel consumption



Operating point

p_{me}	10	bar
Speed	1500	rpm
ϕ	1	

Results



Thank you for your attention.

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