

# Contents

## **1 Introduction 1**

1.1 Motivation of the study .....	2
1.2 Objectives .....	4
1.3 Background .....	5
1.4 Methodology .....	7
Bibliography .....	10

## **2 Background and state of the art 15**

2.1 Introduction .....	16
2.2 Pollutant removal in lean combustion engines .....	16
2.3 Strategies to improve the ATS performance .....	25
2.4 Approaches to flow-through catalyst modelling .....	30
2.5 Summary .....	33
Bibliography .....	33

## **3 1D-lumped model for flow-through aftertreatment systems 47**

3.1 Introduction .....	49
3.2 Pressure drop model .....	52
3.3 Heat transfer model .....	53
3.4 Chemical mechanism modelling .....	59
3.5 Outlet gas properties .....	68
3.6 DOC application case .....	69
3.7 LNT application case .....	87
3.8 SCR application case .....	100
3.9 Summary .....	106
A Appendix: Solution terms for LNT model .....	107
B Appendix: Solution terms for SCR model .....	110
Bibliography .....	111

## **4 Channel cross-section impact on DOC 117**

4.1 Introduction .....	118
4.2 Cell geometry influence on model parameters .....	118
4.3 CO&HC abatement under driving conditions .....	126
4.4 Summary .....	139
Bibliography .....	141

<b>5 Exhaust gas composition effects on DOC 143</b>	
5.1 Introduction .....	144
5.2 RCCI application case .....	145
5.3 Alternative fuels application case .....	165
5.4 Summary .....	183
Bibliography .....	187
<b>6 Pre-turbine pre-DOC influence on WLTC emissions 191</b>	
6.1 Introduction .....	192
6.2 Experimental setup .....	192
6.3 Discussion of the results .....	196
6.4 Summary .....	210
Bibliography .....	212
<b>7 Conclusions and future works 215</b>	
7.1 Main contributions and conclusions .....	216
7.2 Future works .....	224
Bibliography .....	229
<b>Global bibliography</b>	<b>231</b>