

Contents

Acknowledgements	iii
Abstract	iv
Kurzfassung	v
Conventions	xiii
Acronyms, Symbols and Abbreviations	xiv
1 Introduction	1
2 State of the art	4
2.1 Control problems in diesel engines	4
2.1.1 General remarks	4
2.1.2 Main input-output relations	11
2.1.3 Main control loops	13
2.1.4 Control strategies	15
2.2 Modelling of diesel engines	19
2.2.1 Modelling classification	19
2.2.2 Mean Value Modelling	22
2.2.3 Regression models	24
2.2.4 Design of Experiments	28
2.3 Connectivity in the automotive field	31
2.3.1 General remarks	31
2.3.2 Enabling technologies	32
2.3.3 Application fields	34
3 Predictive control of selected diesel engine subsystems	37
3.1 Predictive control of a diesel engine air-path	39
3.1.1 Model description and simulation boundary conditions	39
3.1.2 Development of the predictive control strategy	41
3.1.3 Simulative investigation	45
3.2 Predictive control of a LNT system	47
3.2.1 Model description and simulation boundary conditions	47
3.2.2 Development of the predictive control strategy	50
3.2.3 Simulative investigation	52
3.3 Predictive control of a DPF system	55

3.3.1	Model description and simulation boundary conditions	55
3.3.2	Development of the predictive control strategy	58
3.3.3	Simulative investigation	61
4	Predictive supervisory controller for diesel engines	64
4.1	Control framework	65
4.1.1	Engine and aftertreatment control modules	67
4.2	Simulative investigation	68
4.2.1	Engine and aftertreatment modelling	68
4.2.2	Optimal control problem	70
4.2.3	Implementation methodology	71
4.2.4	Simulation results	72
4.3	Experimental validation	75
4.3.1	Engine configuration in the test-bench and test planning	75
4.3.2	Engine and aftertreatment modelling	76
4.3.3	Optimal control problem definition and implementation	81
4.3.4	Tuning of the optimal control problem parameters	82
4.3.5	In-use emission limits generation	84
4.3.6	Measurement results	88
5	Summary and outlook	96
A	Investigated driving cycles	99
B	K_1 factor	102
	Bibliography	104
	Curriculum Vitae	115