

# CONTENTS

RESUMÉ .....	7
ABSTRACT .....	9
CONTENTS .....	11
LIST OF FIGURES.....	13
LIST OF TABLES.....	17
LIST OF SYMBOLS AND ABBREVIATIONS .....	18
INTRODUCTION .....	27
1 STATE OF ART .....	29
2 DISSERTATION GOALS .....	35
3 THEORETICAL FRAMEWORK.....	37
3.1 MODELING AND SIMULATION .....	37
3.1.1 <i>Types of Systems</i> .....	37
3.1.2 <i>Modelling</i> .....	38
3.1.3 <i>Steady-state Analysis</i> .....	43
3.1.4 <i>Dynamic Analysis</i> .....	46
3.2 IDENTIFICATION AND CONTROL .....	48
3.2.1 <i>Adaptive Control</i> .....	48
External Linear Models .....	49
ELM Parameters Identification.....	51
Polynomial Control System Synthesis.....	60
3.2.2 <i>Predictive Control</i> .....	72
Formulation of Generalized Predictive Control.....	73
Computation of Generalized Predictive Control.....	75
3.3 MAIN TYPES OF CHEMICAL REACTORS.....	79
4 EXPERIMENTAL PART .....	85
4.1 CONTINUOUS STIRRED TANK REACTOR.....	85
4.1.1 <i>Description of the Model</i> .....	85
4.1.2 <i>Steady-state Analysis</i> .....	88

4.1.3	<i>Dynamic Analysis</i> .....	91
4.1.4	<i>Simulation of Control</i> .....	95
	Adaptive Control with Pole-placement Method.....	97
	Adaptive Control With LQ Approach.....	104
	Adaptive Control with Continuous-time ELM .....	108
	Predictive Control.....	113
	The Best Results of Each Control Strategy .....	114
4.2	PLUG-FLOW REACTOR (PFR).....	116
4.2.1	<i>Description of the Model</i> .....	116
4.2.2	<i>Steady-state Analysis</i> .....	120
4.2.3	<i>Dynamic Analysis</i> .....	125
4.2.4	<i>Simulation of Control</i> .....	129
	Adaptive Control with Pole-assignment Method.....	131
	Adaptive Control with LQ Approach.....	134
	Predictive Control.....	135
	The Best Results of Each Control Strategy .....	137
4.3	REAL MODEL OF CSTR.....	138
4.3.1	<i>Description of the Chemical Process</i> .....	142
4.3.2	<i>Static and Dynamic Analyses</i> .....	144
4.3.3	<i>Control Analysis</i> .....	145
	Adaptive Control with Pole-assignment Method.....	145
	Adaptive Control with LQ Approach.....	148
	Predictive Control.....	150
	The Best Results of Each Control Strategy .....	151
	<b>CONCLUSIONS AND DISCUSSIONS</b> .....	<b>153</b>
	<b>REFERENCES</b> .....	<b>158</b>
	<b>LIST OF RELATED PUBLICATIONS</b> .....	<b>162</b>
	<b>CURRICULUM VITAE</b> .....	<b>165</b>