

6.1.2	Geometry and mesh	87
6.1.3	Initial turbulent velocity field	88
6.1.4	Flame kernel	90
6.2	Results and discussions	90
6.2.1	Early growth phase	90
6.2.2	Pressure rising phase	97
6.2.3	Local flame properties	104
6.2.4	Flame-wall interactions	113
7	CONCLUSION AND OUTLOOK	125
7.1	laminar 2D flame	125
7.2	Turbulent 2D cases	126
7.3	Turbulent 3D cases	127
7.4	Future work	128
A	APPENDIX	131
	Listings	131
	List of Tables	137
	List of Figures	140
	BIBLIOGRAPHY	151

# CONTENTS

---

Nomenclature      xv

1	INTRODUCTION	1
1.1	Motivation	1
1.2	Objective of this study	3
1.3	Structure of the thesis	3
2	LITERATURE REVIEW	5
2.1	DNS of turbulent premixed flames	5
2.2	Flame-wall interactions	13
2.2.1	Experimental studies	14
2.2.2	Numerical studies	17
3	METHODOLOGY	25
3.1	Governing equations	25
3.2	Premixed flame aerodynamics	27
3.3	Random turbulent initial velocity field	28
4	LAMINAR FLAME-WALL INTERACTIONS	31
4.1	Computational setup	31
4.2	Results and discussion	32
4.2.1	Phenomenology	32
4.2.2	Flow topology and flame-flow interactions	35
4.2.3	Quenching distance	41
4.2.4	Heat transfer processes	43
5	TURBULENT 2D FLAMES	57
5.1	Simulation setup	57
5.2	Results	58
5.2.1	Early growth	58
5.2.2	Pressure-rising phase	65
5.3	High pressure 2D cases	81
6	TURBULENT 3D FLAMES	87
6.1	Simulation setup	87
6.1.1	Thermo-chemical conditions	87