

Contents

Contents	xiii
List of Figuresxv
List of Tablesxx
Nomenclature	xxi
1 Introduction	1
1.1 Background	2
1.2 Motivation	4
1.3 Objectives	6
1.4 Working plan	7
1.5 Contents	8
1.6 References	10
2 Literature review	13
2.1 Introduction	14
2.2 Twin-entry radial turbines performance	15
2.3 Experimental characterisation	18
2.4 CFD characterisation and modelling	19
2.5 One-dimensional models	21
2.6 Summary	27
2.7 References	28
3 Experimental tests in twin-entry turbines	37
3.1 Introduction	39
3.2 Twin-entry turbine	39
3.3 Test bench	39
3.4 Steady-state measurements	44
3.5 LDA tests	47
3.6 Outlet temperature measurements	62
3.7 Summary	66
3.8 References	67
4 CFD simulations setup	69
4.1 Introduction	70
4.2 CFD simulations setup	70
4.3 Global validation	78
4.4 Summary	80
4.5 References	81

5 CFD simulations flow and losses analysis	83
5.1 Introduction	85
5.2 Mass flow analysis	85
5.3 Losses analysis	96
5.4 Summary	122
5.5 References	125
6 1D twin-entry turbine modelling	127
6.1 Introduction	129
6.2 Effective area model	131
6.3 Losses-based efficiency model	138
6.4 Adjusting procedure	157
6.5 Summary	159
6.6 References	161
7 Results	163
7.1 Introduction	166
7.2 Flow capacity map extrapolation	166
7.3 Efficiency map extrapolation	179
7.4 Flow analysis and models performance with a different geometry	195
7.5 Summary	204
7.6 References	206
8 Conclusions and future works	207
8.1 Introduction	208
8.2 Experimental analysis	208
8.3 CFD analysis	209
8.4 Twin-entry turbine modelling	210
8.5 General conclusions	213
8.6 Limitations and future works	213
References	215