

# Contents

<b>1. Introduction</b>	<b>1</b>
1.1. Motivation . . . . .	1
1.2. Objectives . . . . .	2
1.2.1. Specific Objectives . . . . .	2
1.3. Scope of this study . . . . .	2
<b>2. Literature Review</b>	<b>3</b>
2.1. Heat Exchangers . . . . .	3
2.2. Longitudinal Vortex Generators . . . . .	4
2.3. Governing equations . . . . .	5
2.3.1. Continuity Equation . . . . .	5
2.3.2. Momentum Equation . . . . .	5
2.3.3. Energy Equation . . . . .	5
2.4. Previous Research . . . . .	6
<b>3. Solution Method</b>	<b>11</b>
3.1. Physical Model . . . . .	11
3.1.1. Validation Model . . . . .	11
3.1.2. TFHE's Designs . . . . .	12
3.2. Boundary conditions . . . . .	15
3.2.1. Upstream-extended region . . . . .	16
Inlet boundary . . . . .	16
Upper and lower boundaries . . . . .	16
Lateral boundaries . . . . .	16
3.2.2. Downstream-extended region . . . . .	16
Upper and lower boundaries . . . . .	16
Lateral boundaries . . . . .	16
Outlet boundary . . . . .	16
3.2.3. Fin region . . . . .	16
Fin surface and tube . . . . .	16
Lateral boundaries . . . . .	16
3.2.4. Parameters . . . . .	17
Hydraulic Diameter . . . . .	17
Area-average pressure . . . . .	17
Bulk Temperature . . . . .	17
Log-mean temperature difference . . . . .	17
Heat transfer rate . . . . .	17

Heat transfer coefficient . . . . .	17
Reynolds Number . . . . .	17
Nusselt Number . . . . .	18
Local Nusselt Number . . . . .	18
Span average Nusselt Number . . . . .	18
Average Nusselt Number . . . . .	18
Friction factor . . . . .	18
Thermal performance factor . . . . .	18
3.3. Model Validation . . . . .	19
3.3.1. Grid generation . . . . .	19
3.3.2. Numerical method . . . . .	19
3.3.3. Validation results . . . . .	20
3.4. Grid Independence . . . . .	21
<b>4. Results and discussion</b>	<b>23</b>
4.1. Thermohydraulic behaviour . . . . .	23
4.1.1. Case 0 . . . . .	23
4.1.2. Case 1 . . . . .	25
4.1.3. Case 2 . . . . .	27
4.1.4. Case 3 . . . . .	29
4.1.5. Case 4 . . . . .	30
4.1.6. Case 5 . . . . .	32
4.2. Cases comparisons . . . . .	35
<b>5. Conclusions</b>	<b>41</b>
<b>Bibliography</b>	<b>43</b>
<b>Appendix A. Grid Independence</b>	<b>46</b>
<b>Appendix B. Inlet Velocities</b>	<b>47</b>
<b>Appendix C. Results Obtained</b>	<b>48</b>
<b>Appendix D. Contours</b>	<b>51</b>
<b>Appendix E. Span average Nusselt number code.</b>	<b>57</b>