<table>
<thead>
<tr>
<th>CHAPTER NO.</th>
<th>TITLE</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6</td>
<td>DRY BAND FORMATION STUDIES</td>
<td>24</td>
</tr>
<tr>
<td>2.6.1</td>
<td>Tests for the uniformity of the pollution coating</td>
<td>25</td>
</tr>
<tr>
<td>2.6.2</td>
<td>Dry band formation tests</td>
<td>28</td>
</tr>
<tr>
<td>2.6.3</td>
<td>Dry band under controlled non-uniformity</td>
<td>30</td>
</tr>
<tr>
<td>2.7</td>
<td>SCINTILLATION AND FLASHOVER STUDIES</td>
<td>33</td>
</tr>
<tr>
<td>2.7.1</td>
<td>Effect of location of dry band</td>
<td>36</td>
</tr>
<tr>
<td>2.7.2</td>
<td>Effect of a wet patch in a dry zone</td>
<td>38</td>
</tr>
<tr>
<td>2.7.3</td>
<td>Effect of a tall pin</td>
<td>38</td>
</tr>
<tr>
<td>2.7.4</td>
<td>Effect of circular ribs</td>
<td>39</td>
</tr>
<tr>
<td>2.8</td>
<td>CONCLUSION</td>
<td>43</td>
</tr>
<tr>
<td>3</td>
<td>MODELS FOR POLLUTION STUDIES ON BUSHINGS</td>
<td>44</td>
</tr>
<tr>
<td>3.1</td>
<td>INTRODUCTION</td>
<td>44</td>
</tr>
<tr>
<td>3.2</td>
<td>GEOMETRIC APPROXIMATION OF A BUSHING - DERIVATION OF UNILATERALLY KINDRED MODEL</td>
<td>44</td>
</tr>
<tr>
<td>3.2.1</td>
<td>Mathematical calculation of the initial potential distribution on the model</td>
<td>47</td>
</tr>
<tr>
<td>3.2.2</td>
<td>Comparison of the calculated values of initial potential distribution with the experimental values on actual bushing</td>
<td>49</td>
</tr>
<tr>
<td>CHAPTER NO.</td>
<td>TITLE</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>3.2.3</td>
<td>Comparison of the initial potential distribution on bushing and model</td>
<td>52</td>
</tr>
<tr>
<td>3.3</td>
<td>DRY BAND FORMATION STUDIES</td>
<td>53</td>
</tr>
<tr>
<td>3.3.1</td>
<td>Tests for the uniformity of the pollution coating</td>
<td>53</td>
</tr>
<tr>
<td>3.3.2</td>
<td>Dry band formation tests</td>
<td>55</td>
</tr>
<tr>
<td>3.4</td>
<td>LIMITATIONS OF UNILATERALLY KINDRED MODEL</td>
<td>57</td>
</tr>
<tr>
<td>3.5</td>
<td>CONCLUSION</td>
<td>57</td>
</tr>
<tr>
<td>4</td>
<td>A NEW THREE DIMENSIONAL MODEL FOR BUSHINGS</td>
<td>58</td>
</tr>
<tr>
<td>4.1</td>
<td>INTRODUCTION</td>
<td>58</td>
</tr>
<tr>
<td>4.2</td>
<td>SIMPLIFICATION OF BUSHING SHAPE</td>
<td>58</td>
</tr>
<tr>
<td>4.2.1</td>
<td>Comparison of the predicted data of IPD with the experimental data on bushing</td>
<td>60</td>
</tr>
<tr>
<td>4.3</td>
<td>DERIVATION OF A THREE DIMENSIONAL MODEL FOR BUSHINGS</td>
<td>63</td>
</tr>
<tr>
<td>4.3.1</td>
<td>Comparison of the predicted data and the experimental data of the IPD on the bushing and the model</td>
<td>63</td>
</tr>
<tr>
<td>4.4</td>
<td>DRY BAND FORMATION STUDIES</td>
<td>70</td>
</tr>
<tr>
<td>4.4.1</td>
<td>Dry band formation tests</td>
<td>71</td>
</tr>
<tr>
<td>CHAPTER NO.</td>
<td>TITLE</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>4.5</td>
<td>SCINTILLATION AND FLASHOVER STUDIES</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>4.5.1 Case study 1</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>4.5.2 Case study 2</td>
<td>74</td>
</tr>
<tr>
<td>4.6</td>
<td>NON-UNIFORM RAIN TESTS ON THE BUSHING AND THE MODEL</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>4.6.1 Experiments with gradually increasing voltage</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>4.6.2 Experiments with constant voltage application</td>
<td>80</td>
</tr>
<tr>
<td>4.7</td>
<td>CONCLUSION</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>DK MODEL EXTENDED TO A CONDENSER TYPE BUSHING</td>
<td>84</td>
</tr>
<tr>
<td>5</td>
<td>INTRODUCTION</td>
<td>84</td>
</tr>
<tr>
<td>5.2</td>
<td>THEORY OF CONDENSER BUSHINGS</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>5.2.1 Non-condenser bushing</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>5.2.2 Condenser bushing</td>
<td>86</td>
</tr>
<tr>
<td>5.3</td>
<td>CALCULATION OF CAPACITIVE GRADING</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>5.3.1 A physical model for a condenser bushing</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>5.3.2 Calculation of the capacitors to be connected</td>
<td>89</td>
</tr>
<tr>
<td>5.4</td>
<td>EXPERIMENTAL SET UP</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>5.4.1 Bushing and model with metallic rings</td>
<td>94</td>
</tr>
<tr>
<td>CHAPTER NO.</td>
<td>TITLE</td>
<td>PAGE NO.</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>6</td>
<td>ESTIMATION OF THE TIME TO FLASHOVER IN HVDC WALL BUSHINGS</td>
<td>103</td>
</tr>
<tr>
<td></td>
<td>6.1 INTRODUCTION</td>
<td>103</td>
</tr>
<tr>
<td></td>
<td>6.2 SURFACE RESISTANCE MEASUREMENTS ON THE DK MODEL UNDER RAIN</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>6.3 MATHEMATICAL MODEL FOR THE ESTIMATION OF THE TIME TO FLASHOVER IN HVDC WALL BUSHING</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>6.4 NETWORK MODEL OF HVDC WALL BUSHING</td>
<td>115</td>
</tr>
<tr>
<td></td>
<td>6.4.1 Circuit analysis</td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>6.5 DRY AND WET ZONE VOLTAGE VARIATION WITH TIME</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td>6.6 CONCLUSION</td>
<td>120</td>
</tr>
</tbody>
</table>

<p>| 7          | CONCLUSION | 130 |
|            | 7.1 CONCLUDING REMARKS | 130 |
|            | 7.2 SCOPE FOR FUTURE WORK | 133 |</p>
<table>
<thead>
<tr>
<th>CHAPTER NO.</th>
<th>TITLE</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX 1</td>
<td>MATHEMATICAL ANALYSIS OF THE SIMPLIFIED MODEL OF THE BUSHING</td>
<td>134</td>
</tr>
<tr>
<td>A1.1</td>
<td>INTRODUCTION</td>
<td>134</td>
</tr>
<tr>
<td>A1.2</td>
<td>DERIVATION OF THE CURRENT DENSITY DISTRIBUTION</td>
<td>134</td>
</tr>
<tr>
<td>A1.3</td>
<td>CALCULATION OF SURFACE RESISTANCE OF VARIOUS REGIONS</td>
<td>137</td>
</tr>
<tr>
<td>APPENDIX 2</td>
<td>MATHEMATICAL ANALYSIS OF DK MODEL</td>
<td>139</td>
</tr>
<tr>
<td>A2.1</td>
<td>INTRODUCTION</td>
<td>139</td>
</tr>
<tr>
<td>A2.2</td>
<td>CALCULATION OF SURFACE RESISTANCE OF VARIOUS REGIONS</td>
<td>139</td>
</tr>
<tr>
<td>REFERENCES</td>
<td></td>
<td>142</td>
</tr>
<tr>
<td>VITAE</td>
<td></td>
<td>147</td>
</tr>
</tbody>
</table>