LCD Optimization and Modeling
Project I.D: CV1c-04

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Overview

Nowadays, the LCD is very popular and widely used in our daily lives due to its small size and low power consumption. They are used in PDAs, mobile phones, notebooks, desktop computer monitors and even LCD TVs. However, comparing with CRT, LCD has a lower contrast and slower response time. So, LCD is unable to provide a fast moving full motion video. That’s why the LCD still cannot replace the classical CRT.

The aim of our project is to improve the response time of the following six types of LCDs:

i) Twisted Nematic (TN)
ii) Super Twisted Nematic (STN)
iii) Electrically controlled birefringence (ECB)
iv) Bend-aligned cell (\(\pi\)-cell)
v) Vertically Aligned Nematic (VAN)
vi) Hybrid Aligned Nematic (HAN)
To optimize the performance of the LCDs, a software called MOUSE-LCD is used.

The optimizing procedure is carried out as the followings:

1. Adjust the parameters
2. Simulation with MOUSE-LCD
3. Optimization
4. Optimized LCD
### Result

<table>
<thead>
<tr>
<th></th>
<th>$\tau_{on}$ (ms)</th>
<th>$\tau_{eff}$ (ms)</th>
<th>$\tau_{total}$ (ms)</th>
<th>Transmittance</th>
<th>Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>TN-cell</td>
<td>1.799</td>
<td>11.665</td>
<td>13.46</td>
<td>0.4145</td>
<td>249</td>
</tr>
<tr>
<td>ECB-cell</td>
<td>1.49</td>
<td>12.8</td>
<td>14.2</td>
<td>0.4372</td>
<td>111</td>
</tr>
<tr>
<td>HAN-cell</td>
<td>0.885</td>
<td>12.54</td>
<td>13.425</td>
<td>0.4571</td>
<td>346.18</td>
</tr>
<tr>
<td>VAN-cell</td>
<td>2.357</td>
<td>21.462</td>
<td>23.82</td>
<td>0.43</td>
<td>431.45</td>
</tr>
<tr>
<td>Half-$\pi$-cell</td>
<td>0.481</td>
<td>3.133</td>
<td>3.614</td>
<td>0.3533</td>
<td>16.11</td>
</tr>
<tr>
<td>STN-cell</td>
<td>47.22</td>
<td>44.109</td>
<td>91.33</td>
<td>0.418</td>
<td>223.17</td>
</tr>
</tbody>
</table>

### Sample: HAN cell

**Response Time**

- **22.681 ms**

**Spectra**

- Contrast and simulated image

**Response Time**

- **13.425 ms**

**Spectra**

- Contrast and simulated image