CV2A-01  LCD OPTIMIZATION AND MODELING

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I) Project Overview

Nowadays, liquid crystal display (LCD) is being widely used for display application. The following show some application of LCD.

1. LCD Projector
2. LCD monitor
3. Mobile phone

For image or multimedia applications, fast response time is necessary condition. In Our Final Year Project, entitled LCD Optimization and Modeling, the response time of 4 types of LCD,
1. twisted nematic (TN),
2. super twisted nematic (STN),
3. vertically aligned nematic (VAN) and
4. optically compensated bend (\(\pi\)-cell)
have been discussed and researched, by using 2 useful software called MOUSE-LCD and DIMOS.

II) Aim and objective

1) Optimizing the various LCD modes.

2) Calculating or simulating the relation between response times of different LCDs and their LC parameters, by using computer software.

3) To understand how backflow effect affects the response time of each kind of LCDs.

4) Compare the response time of the 4 different LCD modes.
III) Result

Figure 1 shows the definition of response time of a LCD. The total response time \( \tau = \tau_{on} + \tau_{off} \).

![Figure 1. Dynamic response of a LCD](image)

Using the 2 software, LC parameters could be inputted to simulate the response time of a LCD.

The response time of the 4 different LCDs is shown in figure 2. Red lines and blue lines represent the switch-off time \( \tau_{off} \) and switch-on time \( \tau_{on} \) of the LCDs respectively.

![Graphs showing response time of LCDs](image)

a) Response time of the TN-cell.  
b) Response time of the VAN-cell
c) Response time of the STN-cell.  d) Response time of the Pi-cell.

Figure 2. Response time of the 4 different LCDs

Also, Table 1 shows the comparison of response time of different types of LC cells.

<table>
<thead>
<tr>
<th>Type of cell</th>
<th>$\tau_{on}$ (msec)</th>
<th>$\tau_{off}$ (msec)</th>
<th>Response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>TN</td>
<td>1-2</td>
<td>3-4</td>
<td>3-6</td>
</tr>
<tr>
<td>STN</td>
<td>40-45</td>
<td>25-30</td>
<td>65-75</td>
</tr>
<tr>
<td>VAN</td>
<td>5-15</td>
<td>~ 5</td>
<td>~10-25</td>
</tr>
<tr>
<td>OCB (pi-cell)</td>
<td>1-2</td>
<td>2-5</td>
<td>3-7</td>
</tr>
</tbody>
</table>

Table 1. Comparison of response time of TN, STN, VAN, Pi-cell.