**Introduction**

In wireless communication and in the early days of cell phone technology, battery performance was the main focus in terms of conservation. The battery suppliers pursued a strategy of improved materials and better packaging to maximize the overall performance.

**Aim and Objectives**

The aim in this FYP was to design two low-voltage low-power CMOS amplifier chips, which consume low power and are capable of operating in the low supply voltages (~1V), are small in size. They can be applied to cellular systems which low power consumption is needed.

The objective is to produce two AMPs which can work under 1V supply while achieving reasonable gain and bandwidth.
Nested Gm-C Compensation Amplifier (NGCC):

Nested Miller Compensation Amplifier Using Feedforward Transconductance Stage (NMCFNR):

Buffer
## Results

### Table Comparison between NGCC and NMCFNR

<table>
<thead>
<tr>
<th>Voltage Gain Vs Temperature (Post-Simulation Results)</th>
<th>Pre-Simulation Results</th>
<th>Post-Simulation Results (include ideal resistors and capacitors, and parasite capacitors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 25°</td>
<td>NGCC</td>
<td>±0.5 V</td>
</tr>
<tr>
<td></td>
<td>NMCFNR</td>
<td></td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>455μW</td>
<td>456μW</td>
</tr>
<tr>
<td></td>
<td>1mW</td>
<td>1mW</td>
</tr>
<tr>
<td>Power</td>
<td>81.6dB</td>
<td>81.4dB</td>
</tr>
<tr>
<td></td>
<td>74dB</td>
<td>73.9dB</td>
</tr>
<tr>
<td>UGF</td>
<td>11.4MHz</td>
<td>9.84MHz</td>
</tr>
<tr>
<td></td>
<td>9.83MHz</td>
<td>9.87MHz</td>
</tr>
<tr>
<td>Slope Rate (V to 1mV)</td>
<td>-3.07V/μs, 6.39V/μs</td>
<td>-3.07V/μs, 7.22V/μs</td>
</tr>
<tr>
<td></td>
<td>-7.87V/μs, 6.39V/μs</td>
<td>-3.02V/μs, 7.24V/μs</td>
</tr>
<tr>
<td></td>
<td>Temperature Variations:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NGCC: 56°</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NMCFNR: 62°</td>
<td></td>
</tr>
<tr>
<td></td>
<td>56°</td>
<td>61.7°</td>
</tr>
<tr>
<td>Phase Margin</td>
<td>74dB</td>
<td>73.66dB</td>
</tr>
<tr>
<td></td>
<td>57dB</td>
<td>57.1dB</td>
</tr>
<tr>
<td>CMRR</td>
<td>-370mV &lt; V_o &lt; 334mV</td>
<td>-386mV &lt; V_o &lt; 339mV</td>
</tr>
<tr>
<td></td>
<td>-250mV &lt; V_o &lt; 290mV</td>
<td>-244mV &lt; V_o &lt; 194mV</td>
</tr>
<tr>
<td>Output Swing</td>
<td>-491mV &lt; V_0 &lt; 500mV</td>
<td>-500mV &lt; V_0 &lt; 492mV</td>
</tr>
<tr>
<td></td>
<td>-500mV &lt; V_0 &lt; 492mV</td>
<td>-500mV &lt; V_0 &lt; 492mV</td>
</tr>
<tr>
<td>Input Common Mode Range</td>
<td>51.5669μV</td>
<td>51.596μV</td>
</tr>
<tr>
<td></td>
<td>19.2μV</td>
<td>19.1μV</td>
</tr>
<tr>
<td>Load Capacitor</td>
<td>10pF</td>
<td></td>
</tr>
</tbody>
</table>

### Graphs

#### Voltage Gain vs Temperature (Post-Simulation Results)

- NGCC: Voltage Gain = 8.14e+01
- NMCFNR: Voltage Gain = 7.39e+01

#### Temperature Variations:
- NGCC: ±1.8dB
- NMCFNR: ±1.1dB