“Current Source DC/AC Converter for Renewable Sources”

A. Cardoso¹, N. Vazquez¹, C. Hernandez¹ J. Vaquero²

¹Electronics Department
Instituto Tecnológico de Celaya
Celaya, Mexico

²Electronics Technology Area,
Universidad Rey Juan Carlos
Móstoles, Spain
Outline

- Introduction
- Proposed dc/ac converter
  - Operating modes
- Proposed controller
- Simulation results
- Conclusions
Introduction

Leakage current
- Reduce efficiency
- Increase grid current distortion
- Give rise to the safety threats
- Reduce PV life time

\[ v_{CM} = \frac{v_{1N} + v_{2N}}{2} + (v_{1N} - v_{2N}) \frac{L_2 - L_1}{2(L_1 + L_2)} \]
Introduction

Transformerless inverter options

✓ Heric
✓ H5
✓ H6, etc
Proposed Scheme

- Proposed photovoltaic transformerless inverter
  - Photovoltaic system
  - DC/AC Converter, current feed
  - Common Mode Inverter Output
Proposed Converter
Proposed Converter

Subcircuit A
Proposed Converter

✓ Subcircuit B
Proposed Converter

Subcircuit C
Proposed Converter

✓ Subcircuit D
Proposed Converter

✓ Subcircuit E
## Switching States

<table>
<thead>
<tr>
<th>Subcircuit A (+)</th>
<th>Subcircuit B (-)</th>
<th>Subcircuit C (0)</th>
<th>Subcircuit D (0)</th>
<th>Subcircuit E (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_1 ) On</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>( S_2 ) Off</td>
<td>On</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>( S_3 ) Off</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>( S_4 ) On</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>( S_5 ) Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>( S_6 ) Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
</tr>
</tbody>
</table>

**Subcircuit A**

- Increases if \( V_{in} \) is greater than \( V_{Cf} \) otherwise decreases.

**Subcircuit B**

- Increases if \( i_L \) is greater than \( i_{Lf} \) otherwise decreases.

**Subcircuit C**

- Increases if \( V_{Cf} \) is greater than \( V_{out} \) otherwise decreases.

**Subcircuit D**

- Increases if \( V_{Cf} \) is greater than \( V_{out} \) otherwise decreases.

**Subcircuit E**

- Increases if \( V_{Cf} \) is greater than \( V_{out} \) otherwise decreases.
Pulsewidth modulation
Auxiliary signals
## Simulation Results

<table>
<thead>
<tr>
<th>L</th>
<th>5µH</th>
<th>$C_f$</th>
<th>10µF</th>
<th>$L_f$</th>
<th>2µH</th>
<th>$C_{out}$</th>
<th>1µF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sine wave voltage for PWM</td>
<td>10 V</td>
<td>Triangular voltage for PWM</td>
<td>±20 V</td>
<td>PV Voltage ($V_{in}$)</td>
<td>120 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line Frequency</td>
<td>60 Hz</td>
<td>Triangular Frequency for PWM</td>
<td>60 kHz</td>
<td>$V_{out}$</td>
<td>120 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Simulation Results

Auxiliary signals A and B, $I_{\text{out}}$, and $I_L$
Simulation Results

Zoom to auxiliary signals A and B, $I_{out}$, and $I_L$
Simulation Results

$V_{out}$, $I_{out}$, and $I_L$
Simulation Results

Leakage current

![Graph showing Leakage current over time](image)
Conclusions

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