Objective
- Proportional current sharing on the basis of source power ratings.
- Low voltage regulation of source buses.
- Reduced communication network.
- Lesser data congestion in the communication network [1].
- Link failure resiliency.
- Easily scalable.

Proposed Technique
Conventional droop controller:
\[ v_{r}^{ref} = v_{0}^{ref} - \frac{d_{j}^{\mu}u_{j}^{rated}}{\Delta v} \]  

Proposed droop controller:
\[ v_{j}^{ref} = v_{0}^{ref} + \Delta v_{j} - \frac{d_{j}^{\mu}u_{j}^{rated}}{\Delta v} \]  
where \( D \) and \( A \) are the degree and adjacency matrices. At steady state, from (6), \( P_{j}^{\mu}u = \bar{P}_{j}^{\mu}u \).

Then (7) becomes,
\[ I_{j}^{\mu}u = (D + I)^{-1}(A + I)\bar{P}_{j}^{\mu}u \]  
which implies
\[ (I - (D + I)^{-1}(A + I)] = 0 \]  

Fig. 1: Droop characteristics with proposed controller.

System used for Simulation

Table 1: Load distribution with time.

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>( R_1 )</th>
<th>( R_2 )</th>
<th>( R_3 )</th>
<th>( R_4 )</th>
<th>( R_5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 &lt; t &lt; 1</td>
<td>6 ( \Omega )</td>
<td>6 ( \Omega )</td>
<td>6.5 ( \Omega )</td>
<td>6.25 ( \Omega )</td>
<td>6 ( \Omega )</td>
</tr>
<tr>
<td>t &gt; 1</td>
<td>4.75 ( \Omega )</td>
<td>6 ( \Omega )</td>
<td>6.5 ( \Omega )</td>
<td>6.25 ( \Omega )</td>
<td>2.4 ( \Omega )</td>
</tr>
</tbody>
</table>

Table 2: System parameters.

Current Waveforms

Voltage Waveforms

Local Average Currents

Fig. 4: Communication graph used for simulation.

Conclusion
Proposed a cooperative control based secondary controller with reduced communication, having steady state responses identical to a secondary controller with full communication.

References