Thinned Arrays

For a large, filled aperture

- Lots of elements & T/R modules and all that goes with that
- Narrow beamwidth ($\approx \frac{\lambda}{D}$)
- How sidelobe level is possible
- Gain $\approx 4\pi A/\lambda^2$
- Mutual coupling as in infinite array

For a thinned array

- Fewer elements & T/R modules
- Narrow beamwidth ($\approx \frac{\lambda}{D}$)
- Average SLL $\approx$ isotropic
- Gain $\approx N$ (# of elements)
- Feed network no longer "periodic"
- Mutual coupling effects differ element-by-element
Fig. 3—Solid curve is the computed radiation pattern of a statistically designed array naturally thinned using as a model the 30 db Taylor circular aperture distribution whose pattern is shown by the dashed curve.

Fig. 10—Computed radiation pattern of a statistically designed array using as a model the 25 db Taylor design (Fig. 2) but with approximately 90 per cent of the elements removed.
<table>
<thead>
<tr>
<th>Taylor Design Side-lobe Level (dB)</th>
<th>Thinning</th>
<th>Maximum of the 1st Three Side-lobes (dB)</th>
<th>Maximum of the Remaining Side-lobes (dB)</th>
<th>Predicted Statistical Average Side-lobe (dB)</th>
<th>Number of Elements</th>
<th>Half-power Beamwidth Δθ</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25</td>
<td>Natural</td>
<td>-26.0</td>
<td>-31.2</td>
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<td>4560</td>
<td>0.023</td>
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<td>-30</td>
<td>70%</td>
<td>-30.0</td>
<td>-32.0</td>
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<td>0.024</td>
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<td>-32.5</td>
<td>-38.4</td>
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<tr>
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</tr>
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</table>

These results from Skolnik, et al., T-AP, July 1964, pp. 406 - 417

Other references for this topic:
- Text by Mailloux, pp. 92 - 106
- Skolnik, Radar Handbook