GA Optimization of Transparent MIMO Antenna for Smartphone

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Background:
- Future mobile communication system: MIMO
  Several antennas on a terminal
- Light weight and thin terminal
  There are no space for antenna installation.
- Transparent MIMO antenna on the display

FEATURES:
- Multi-band operation, (0.7-0.9 GHz), (2.1-2.3 GHz).
- Reduced correlation coefficient between antenna patterns.
- High gain.

TECHNIQUES:
- Design antenna shape by Pareto-genetic algorithm
- Interlink HFSS EM-simulator and MATLAB tool.

PROPOSED ANTENNA DESIGN

Fig.1. 3D- Simulated Smartphone Model with GA optimized antenna pattern.
- Glass ($\varepsilon_r=7$), loss tangent (0.00036).
- Conducting film ($\sigma = 5 \times 10^7$ S/m).
- Metal case ($\sigma = 5 \times 10^7$ S/m).

Fig.2. Optimizing antenna parameters in GA optimization.

SIMULATED RESULTS

<table>
<thead>
<tr>
<th>Elements</th>
<th>BEFORE GA OPTIMIZATION</th>
<th>AFTER GA OPTIMIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzing frequency</td>
<td>0.85 GHz, 2.2 GHz</td>
<td>0.85 GHz, 2.2 GHz</td>
</tr>
<tr>
<td>No. of objective function</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>No. of optimizing variable</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Population size</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Number of generation</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Number of ports</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

CONCLUSION

- A numerical procedure combining GA and HFSS to optimize the shared aperture MIMO antenna pattern for the Smartphone model is developed.
- Next stage is trial manufacturing and evaluation.

keyword: MIMO Antenna, Transparent Conductive Sheet, Multi-Objective Optimization, Genetic Algorithm