Guide-Wave Propagation on 2D Doubly-Periodic Clusters of Multi-Port Resonators

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The recently introduced Tilted-Ellipse Representation of Standing-Wave Patterns [1, 2] provides a fast and inexpensive way for extracting the multi-dimensional, complex scattering-matrices of very large, multi-port microwave systems, by performing computer-simulations of large-scale experimental-measurements that would require a very complex and expensive multi-port Automated Vector Network Analyzer, and a long data-acquisition time. That simulation method is based on the results of a rigorous mathematical analysis [1, 2] of the simultaneous propagation of forward- and backward-waves along virtual measurement lines, connected to the ports of the microwave systems being simulated. That measurement-simulation method is currently being applied to the study of guided-wave propagation on 2D doubly-periodic clusters of directly-coupled, multi-port cylindrical resonators. Very large reductions of the problem-dimensionality is attained, by combining diakoptiks and symmetry-analysis. The complex scattering-matrix of C_{6V}-symmetric unit-cells is circulant, and symmetric around its main-diagonal, due to reciprocity, so that it may be specified using only the first three elements of its first row. Similar order-of-magnitude dimensionality-reductions are attained by interconnecting unit-cells in progressively-larger clusters having the same C_{6V}, and diagonal symmetry. The smallest cluster including only seven cylindrical-resonators is shown in Figure 1.

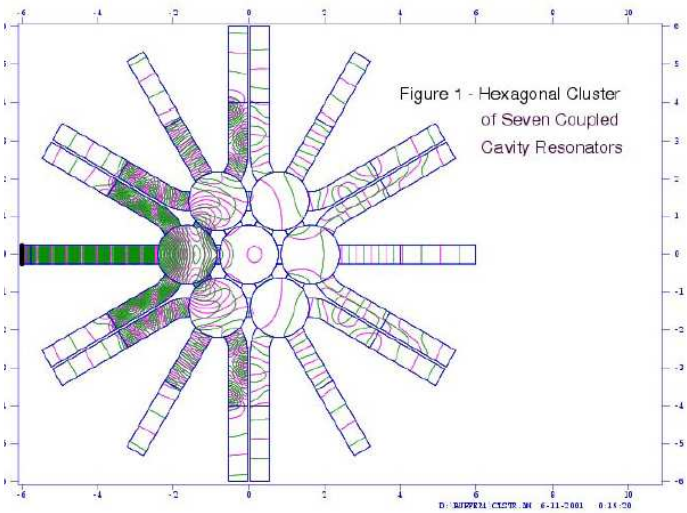

Figure 1:

Guided-wave propagation on such clusters of directly-coupled resonators is being characterized around the resonant frequencies of the TM_{010} and TM_{110} modes, including excitations generating left-/right-hand circular polarizations.

REFERENCES

1. Speciale, R. A., "Computing the scattering matrix of multiport systems," *PIERS 2004*, Pisa, Italy, 2004.
2. Speciale, R. A., "The tilted-ellipse representation of standing-wave patterns," *ACES 2004*, Syracuse, NY, 2004.