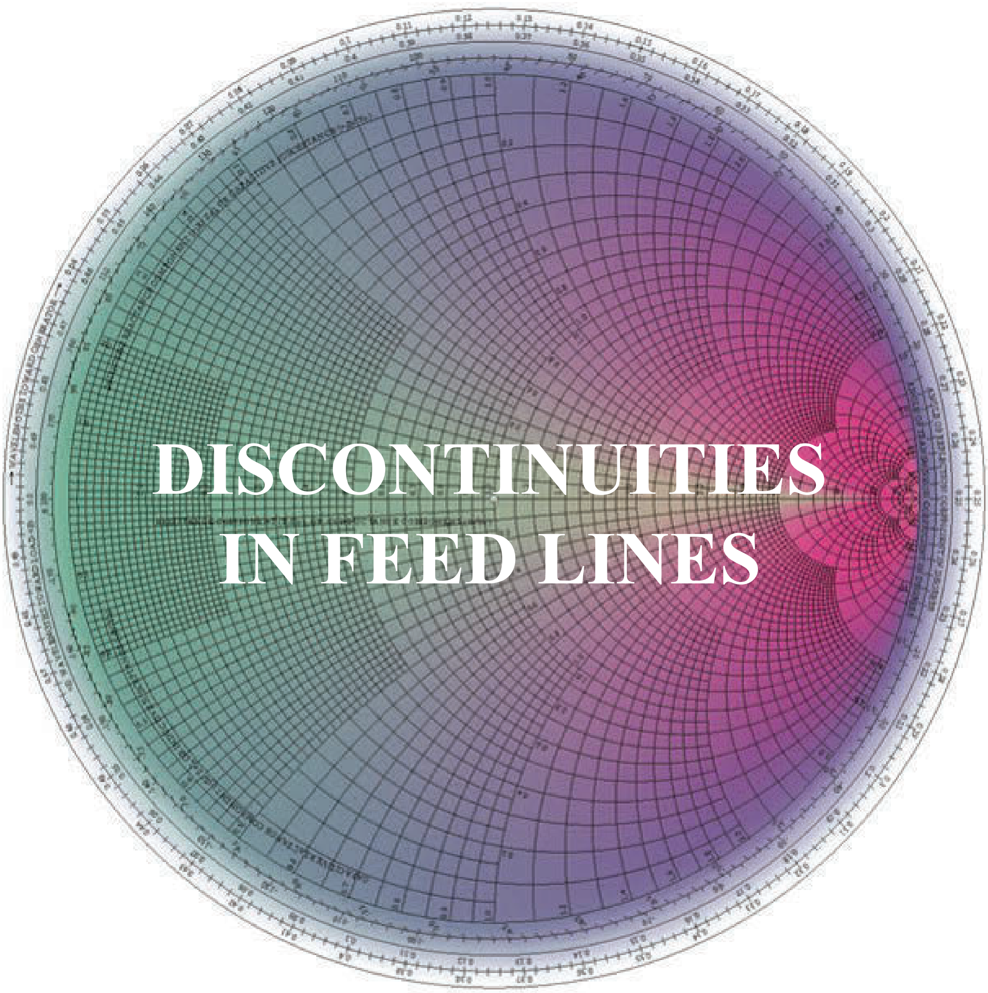
CHAPTER 7



DISCONTINUITIES IN FEED LINES

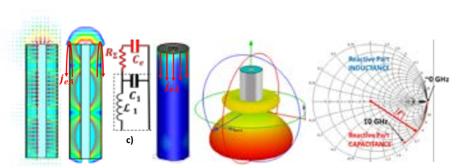
The only way of discovering the limits of the possible is to venture a little way past them into the impossible.

Arthur Clarke's second law

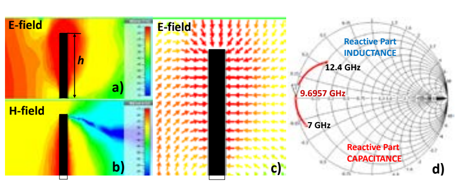
You can learn in Chapter 7

Any regular feed line typically performs better or worse only one but critical task. It transfers EM energy "safely" from some area A to area B. However, in practice, that is far from enough. Many networks including multiple feed sections may be quite complicated and provide the filtering of signals, preliminary linear signal processing, splitting between or combining from various sources of EM energy, and some additional functions depending on system mission. It will not be significant news that any linear RF device or network of such devices is the combination of few or commonly much more than few discontinuities of different types. The first and most important indicator of any discontinuity existence is the alteration of the propagating in line EM field pattern. You learned in Chapter 6 that any such deviation means the appearance in line some extra modes that differ from the propagating one and reflection some portion of energy back to the EM wave sources.

Following our presentation you will become familiar with basic discontinues in coaxial, planar and waveguide lines. Through the multiple images of EM fields surrounding discontinuities, you will understand how to manage them and build high-quality equivalent circuits required for fruitful computer simulation and optimization. You will accustom to reveal the frequency behavior of discontinues through the curves on Smith charts like shown here for open-ended coax. Pay attention to a colorful image of radiation with a peak in the opposite direction to incident wave in line. Except for the open-ended coax, you will learn what to expect from such coax discontinuities as bead supporting the central conductor, step-up of the center conductor, the gap in center conductor, and several different variants of coaxial junctions. Various types of coax and planar discontinuities with common equivalent circuits are revealed in particular table.



Waveguide discontinuities are illustrated on the example of waveguide rectangular (WR) in the manner like shown on your left for resonance post. Smith chart clearly demonstrates the series resonance and almost total energy reflection from the post.



The final section of the chapter introduces you to the world of matrix descriptions of RF circuits and help you eliminate the unambiguous concepts of voltage, current and impedance thereby keeping the conventional and robust circuit technique untouchable. We paid the primary attention to the most universal representation through scattering S-matrix of clear physical meaning and trivial to measure using a wide-spread test equipment Network Analyzer (schematically described). The power of such approach that you may convert if you wish the test data into any other format like T-, Z-, Y-, G-, H-, or ABCD-matrix.

The final section describes one of the computer algorithms how to build S-matrix of the whole from multiple subsets. The latter can be done experimentally that is typically too costly, exhaustive and time-consuming, or to resort the help of high-quality computer models with known matrices.

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