3D Smith Chart tool – version 1.02 released

http://www.3dsmithchart.com/

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The 3D Smith chart tool v. 1.01 was extending the Smith chart capabilities and making it usable for circuits with negative resistance on the unit sphere.

Fig 1: Smith chart bounded by the unit circle, 3D Smith chart, all circle arcs gather together in the south hemisphere. Main idea behind the initial 3D Smith chart tool v.101: Circuits with reflection coefficient magnitude bigger than 1 (negative resistance) are mapped in the South hemisphere, North hemisphere is for passive circuits (with positive input impedance resistance classical Smith chart), East inductive, West capacitive. North pole: perfect match, South pole infinite mismatch. The tool is proposed for amplifier stability analysis, oscillator design, filters and group delay analysis and is based on [1-3].

Based on the preprint article https://arxiv.org/abs/1905.09701 [4], several new functionalities were added into the 3D Smith chart Windows 64 bit compatible chart tool available since 17.07.2019 here: http://www.3dsmithchart.com/

- **3D frequency** (live) sweeping representation (for visualizing the dynamics of the S parameters variation). For example, negative capacitances & positive inductances can be directly distinguished due to their opposed frequency sweeping orientation. Furthermore, no uncertainty on the sweeping range start & end points occurs now while interpreting the results. Illustrated in Fig. 2 and 3.

- **Unique inductor quality factor visualization over the S11 parameters in 3D**, 3D inductance display over the S11 parameter and Q as a generalized cylinder of a radius corresponding to its normalized value for each frequency point. Different models of definitions are used (shunt inductor model, series inductor model), as in Fig. 4.

- **Several improvements in terms of rendering/visualizations**, helpful both in actual design and learning the 2D Smith and 3D Smith chart concepts (axes system, “Greenwich” constant resistance meridian, surface transparency etc) – Fig. 5.
Fig. 2 3D frequency sweeping representation over the $S_{11}$ parameters. The normalized frequency is seen as the distance from the surface for each frequency point of each circuit. The paths of the 2nH and -2pF coincide on a specific frequency range [4], however their orientation on the 1-7 GHz range is different as frequency increases. Green negative capacitance (counter clockwise), cyan (positive inductor).

Fig. 3 3D frequency sweeping representation over the $S_{21}$. The paths of the 2nH inductor and -2pF capacitor represented between 1 and 3 GHz.
Fig. 4 3D Smith chart representation for the shunt inductance and quality factor for different inductors within 1-16 GHz. As the inductance becomes negative it enters the 3D Smith chart interior. The quality factor is represented as a generalized cylinder for each frequency point around the corresponding inductance.

Fig. 5 Improved matching capabilities on r,x,g,b circles: the user can now view the axes, render the circles in a way that improves their depth perception, highlight the “Greenwich” constant resistance meridian and configure the transparencies of the 3D chart.

Explanatory video: https://www.youtube.com/watch?v=kk1aGb8d_rg
Current pricing: http://3dsmithchart.com/#quote