



Spiral Inductors in Shunt and Series

Spiral inductors on a substrate are simulated in shunt and series configurations and their S-parameters extracted.

This article presents FEKO simulations that are representative of RF components that are constructed on a dielectric. The models that are simulated here are shunt and series coupled spiral inductors that were also analyzed by Polycarpou et al [1].

Shunt coupled spiral inductor

Figure 1 depicts the shunt coupled spiral inductor and S-parameter results from [1, Figure 6]. Figure 2 presents the FEKO simulated model and results. The model was constructed with CADFEKO and the substrate modeled as a semi-infinite plane Green's function. The FEKO results compare favorable with the published results [1, Figure 6], validating the FEKO model and simulation techniques. Small differences in the results are due to uncertainties in the model dimensions between the published model and the FEKO model, e.g. length of the main transmission line, exact dimensions of the right angle coupling between the spiral and the w_3 line from the main transmission line.

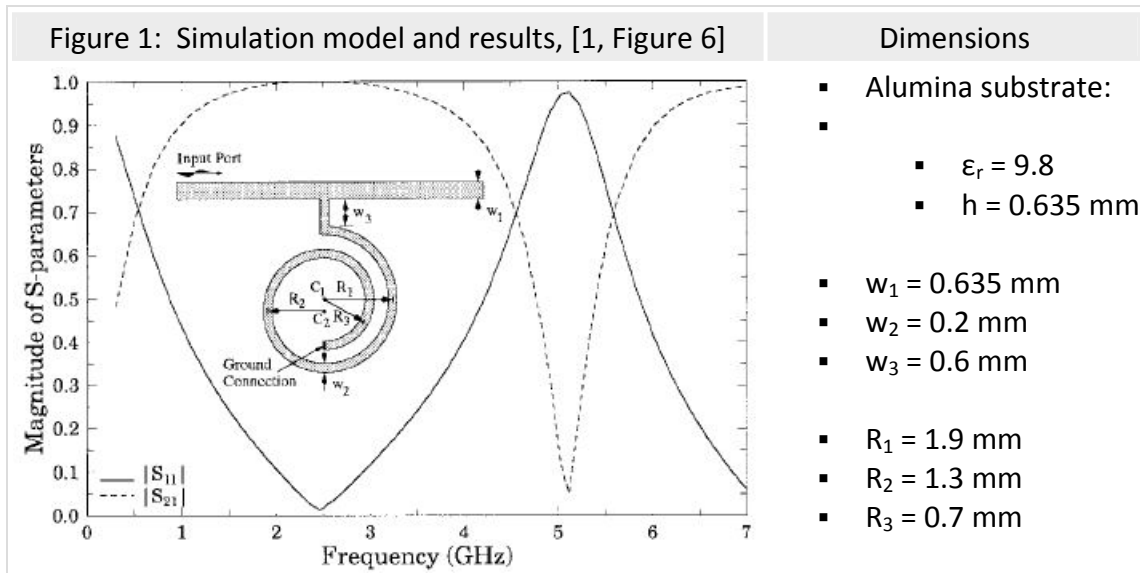
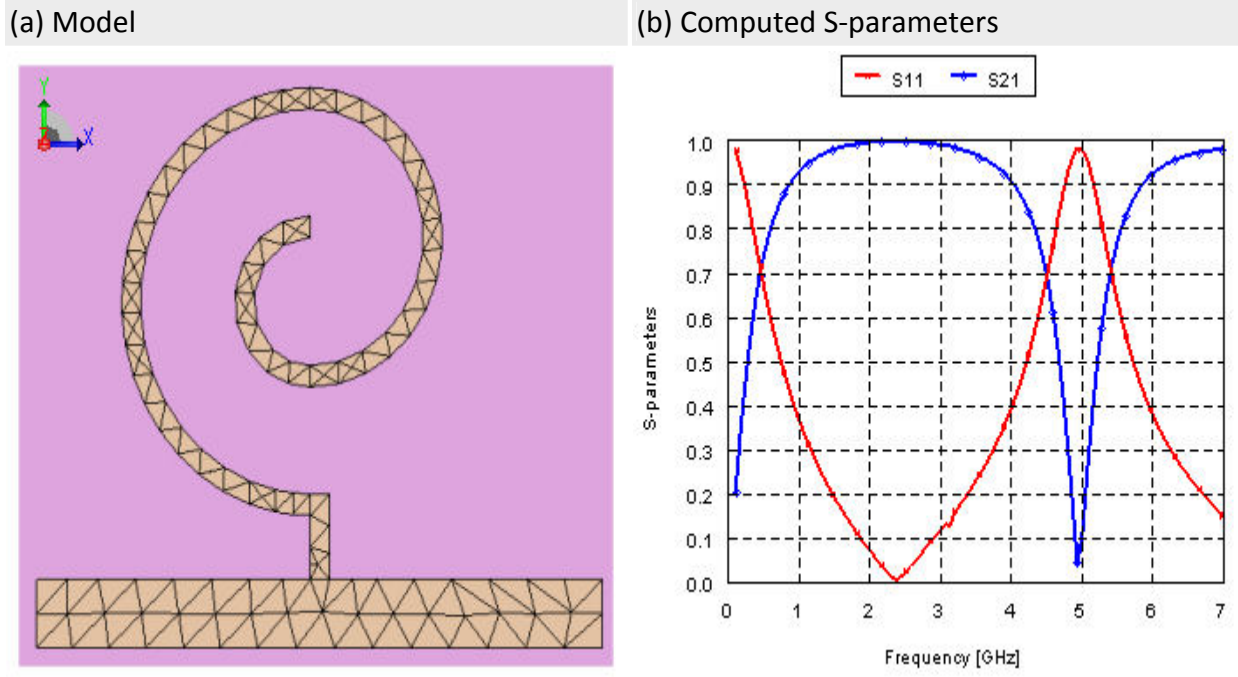


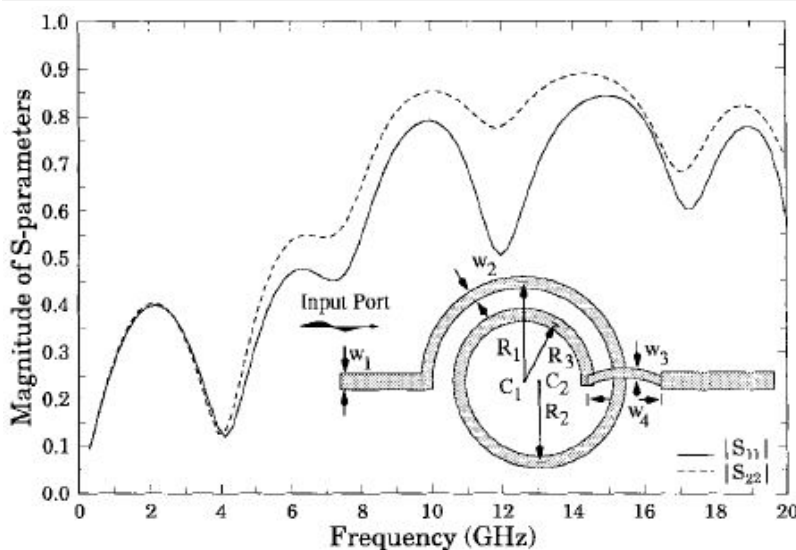
Figure 2: FEKO shunt coupled spiral inductor simulation



Series coupled spiral inductor

Figure 3 depicts the series coupled spiral inductor and S-parameter results from [1, Figure 5]. Figure 4 presents the FEKO simulated model and results. The model was constructed with CADFEKO and the substrate modeled as a semi-infinite plane Green's function. The FEKO results compare favorably with the published results [1, Figure 5], validating the FEKO model and simulation techniques. Small differences can be attributed to geometry uncertainties between the published and FEKO models, e.g. the arch height for the spiral to output Line Bridge and the coupling detail of the spiral to the input line.

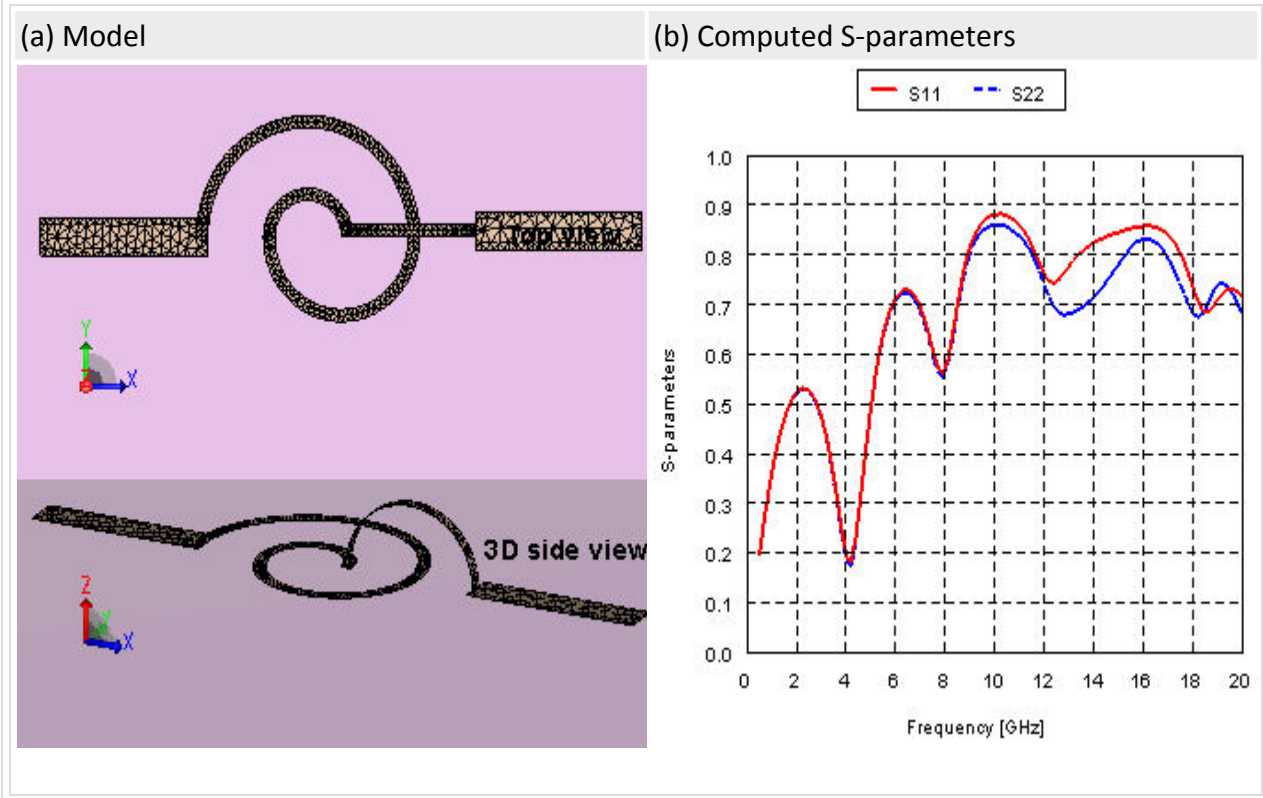
Figure 3: Simulation model and results, [1, Figure 5]



Dimensions

- Alumina substrate:
 - $\epsilon_r = 9.8$
 - $h = 0.635 \text{ mm}$
- $w_1 = 0.635 \text{ mm}$
- $w_2 = 0.2 \text{ mm}$
- $w_3 = 0.2 \text{ mm}$
- $w_4 = 2.3 \text{ mm}$
- $R_1 = 1.9 \text{ mm}$
- $R_2 = 1.3 \text{ mm}$
- $R_3 = 0.7 \text{ mm}$

Figure 4: FEKO series coupled spiral inductor simulation



References

- [1] A.C. Polycarpou, P.A. Tirkas, and C.A. Balanis, "The Finite-Element Method for Modeling Circuits and Interconnects for Electronic Packaging," IEEE Trans. on Microwave Theory and Techniques, Vol. 45, No. 10, October 1997



Copyright © 2010 by EM Software & Systems-SA (Pty)

www.feko.info

