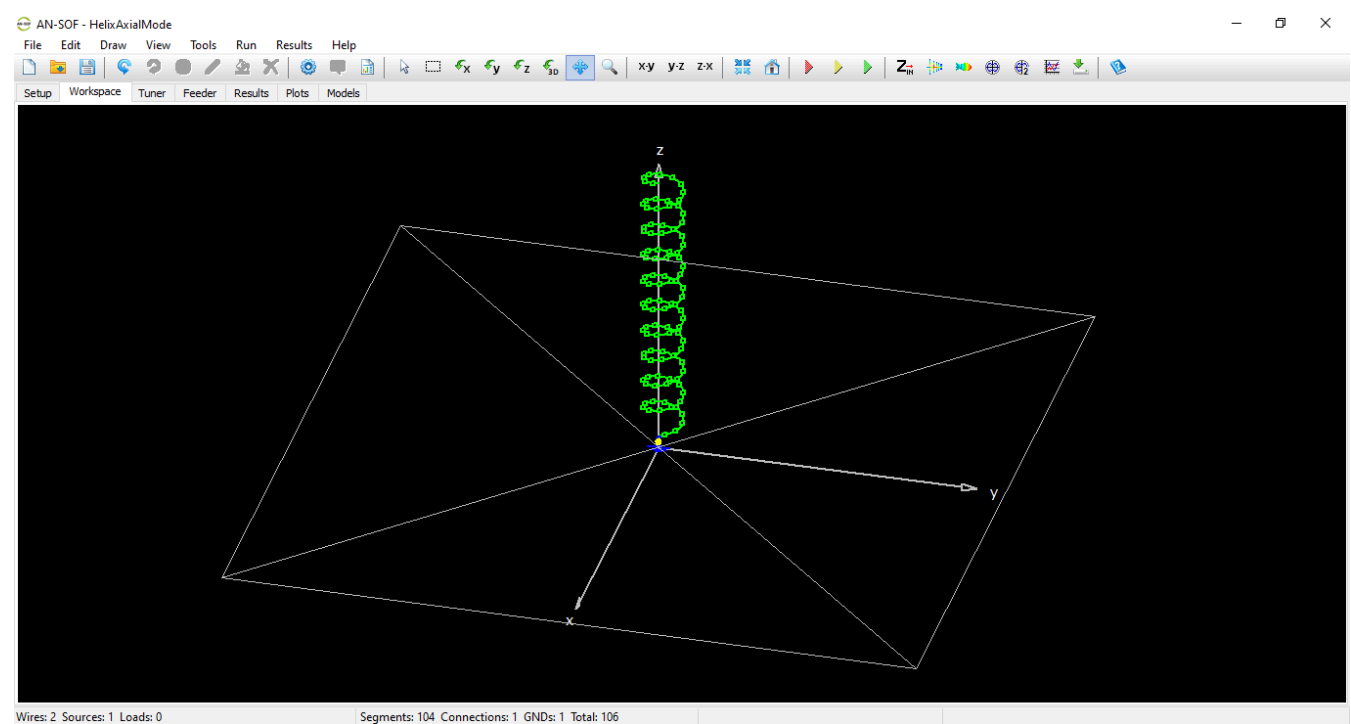


Modeling Helix Antennas in Axial Radiation Mode Using AN-SOF

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Perfect for Beginners: Quick Guide to Helix Antenna Simulation
Master axial-mode helix design in AN-SOF with this easy step-by-step tutorial. Learn ground plane setup, helix creation, and radiation pattern analysis. Start modeling professional antennas today!



Helix Antenna in Axial Mode

The helix antenna demonstrates the importance of curved segments for accurate geometry representation. When the helix length approaches or exceeds the operating wavelength, it operates in *axial mode* – characterized by endfire radiation along its axis. This requires a **ground plane reflector** for proper operation.

Step 1: Setup

1. Frequency Setup:

- Navigate to Setup tabsheet > Frequency panel
- Set operating frequency: **100 MHz**

2. Ground Plane Configuration:

- Go to Environment panel > Ground Plane box
- Select: **Perfect**

- Set position: **Z = 0** (xy-plane) (**Fig. 1**)

3. Excitation:

- Ensure **Discrete Sources** is selected in **Excitation panel**

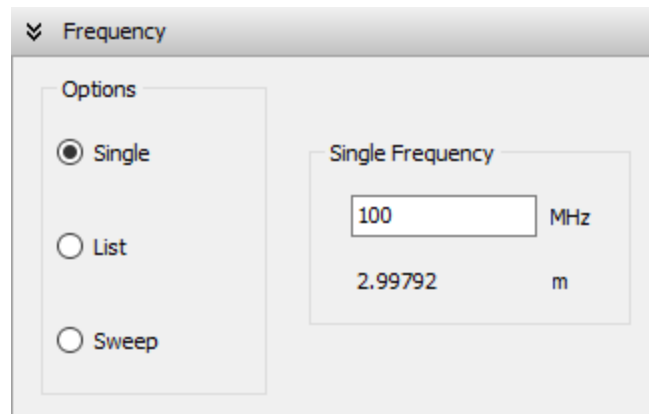


Fig. 1(a): Setting the operating frequency for the helix antenna.

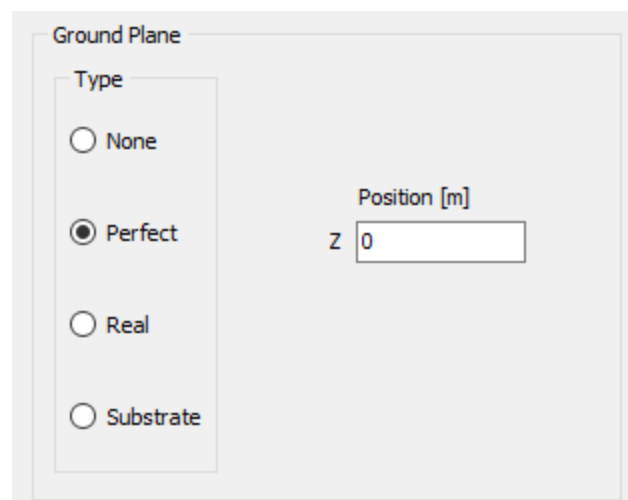


Fig. 1(b): Setting the ground plane for the helix antenna.

Step 2: Drawing the Structure

1. Helix Creation:

- Right-click on the workspace > Select **Helix** from **pop-up menu**
- *Draw Helix* dialog appears (**Fig. 2**)
- Start point: **(0, 0, 0.3) m** (above ground plane)
- Orientation: **Z-axis**

2. Axial Mode Dimensions:

- Set parameters per antenna textbooks:
 - Radius
 - Pitch (turn spacing)
 - Number of turns (*shown in Fig. 2*)
- **Attributes tab:**
 - Segments: **103** (recommended)
 - Cross-section: **Circular**, radius = **3 mm**

3. Ground Connection:

- Right-click helix > **Start Point to GND**
- *Draw Line* dialog auto-populates connection points (**Fig. 3**)
- Set:
 - Segments: **2**
 - Radius: **3 mm**

4. **Source Placement:**

- Right-click vertical wire > **Source/Load/TL**
- Connect voltage source to segment nearest ground plane
(Refer to: **Adding Sources** guide)

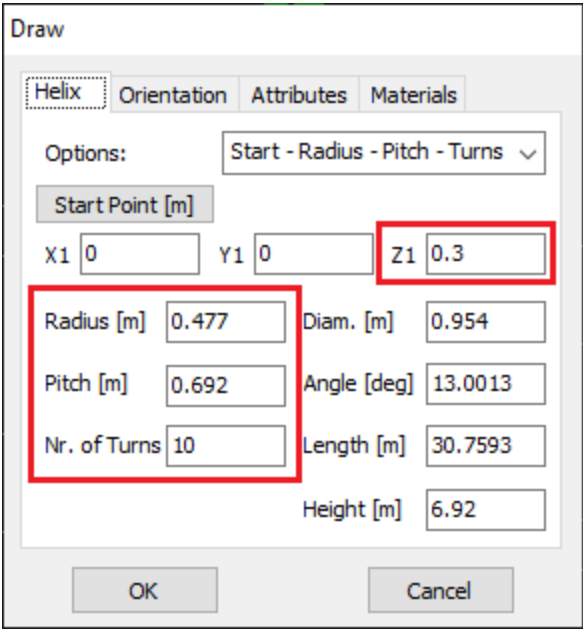


Fig. 2(a): Specifying the helix dimensions.

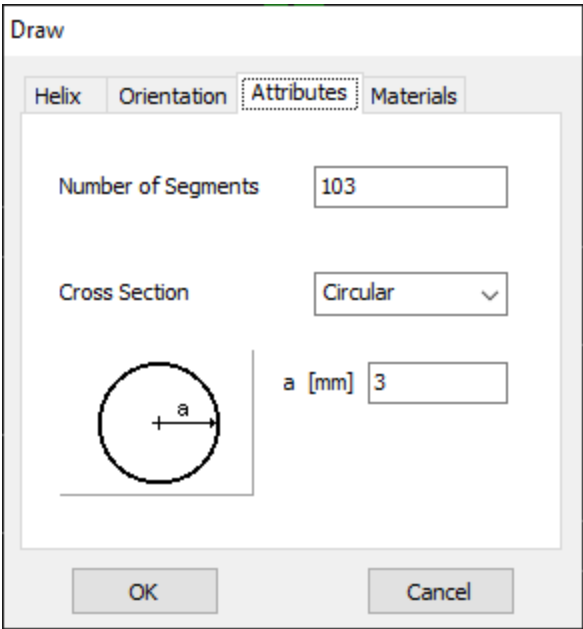


Fig. 2(b): Specifying the helix segmentation and cross-section.

Download Model

Draw

Line Attributes Materials

Options: 2 Points

From Point [m]

X1 0 Y1 0 Z1 0.3

To Point [m]

X2 0 Y2 0 Z2 0

OK Cancel

Fig. 3(a): Specifying the vertical wire that connects the helix to the ground plane.

Draw

Line Attributes Materials

Number of Segments 2

Cross Section Circular

a [mm] 3

OK Cancel

Fig. 3(b): Specifying the segments and cross-section for the vertical wire.

Step 3: Simulation & Analysis

1. Run Simulation:

- Click **Run Currents and Far-Field (F10)**
- View 3D radiation pattern via **Far-Field 3D Plot** button (**Fig. 4a**)
- Observe main lobe along helix axis (axial mode characteristic)

2. Polarization Analysis:

- In **AN-3D Pattern Plot**:
 - Compare *E-right* vs. *E-left* components (**Figs. 4b, 4c**)
- For accurate comparison:
 - Set matching scale maxima (*Edit > Preferences*)

3. Left-Handed Variant:

- Create by specifying **negative turn count**
- Re-run simulation and compare polarization components

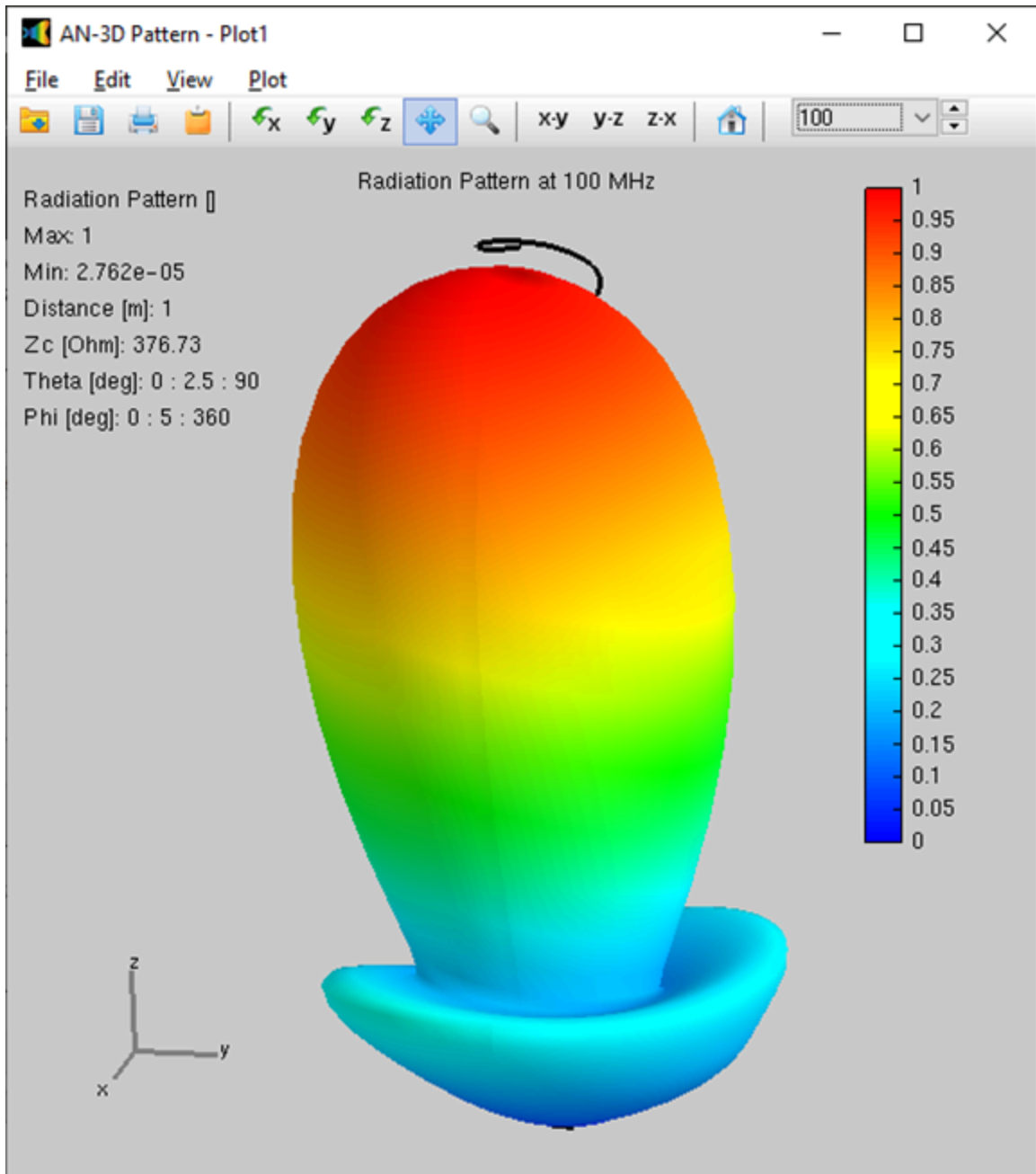


Fig. 4(a): Normalized radiation pattern of the helix.

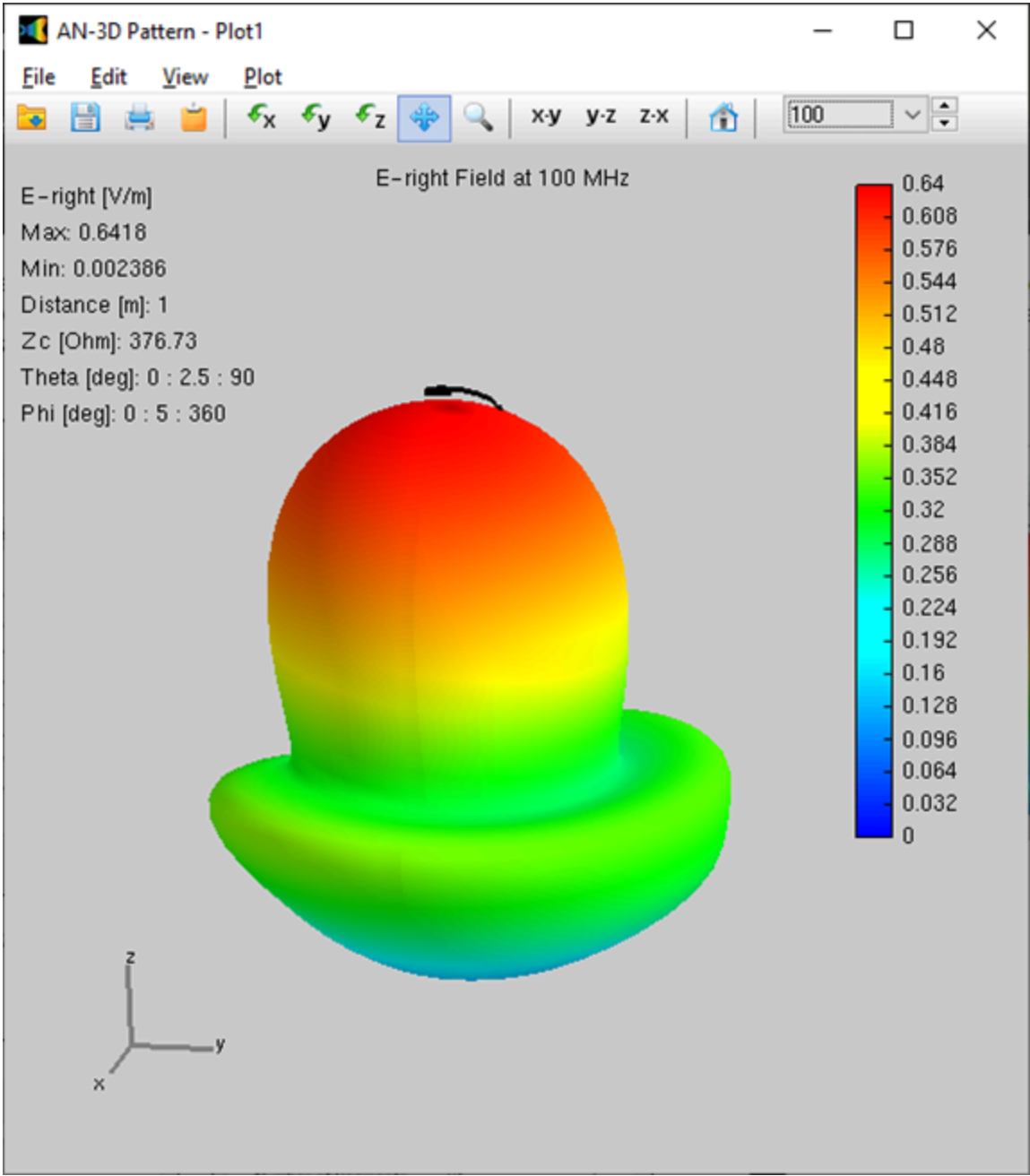


Fig. 4(b): Right-handed circularly polarized component of the far-field.

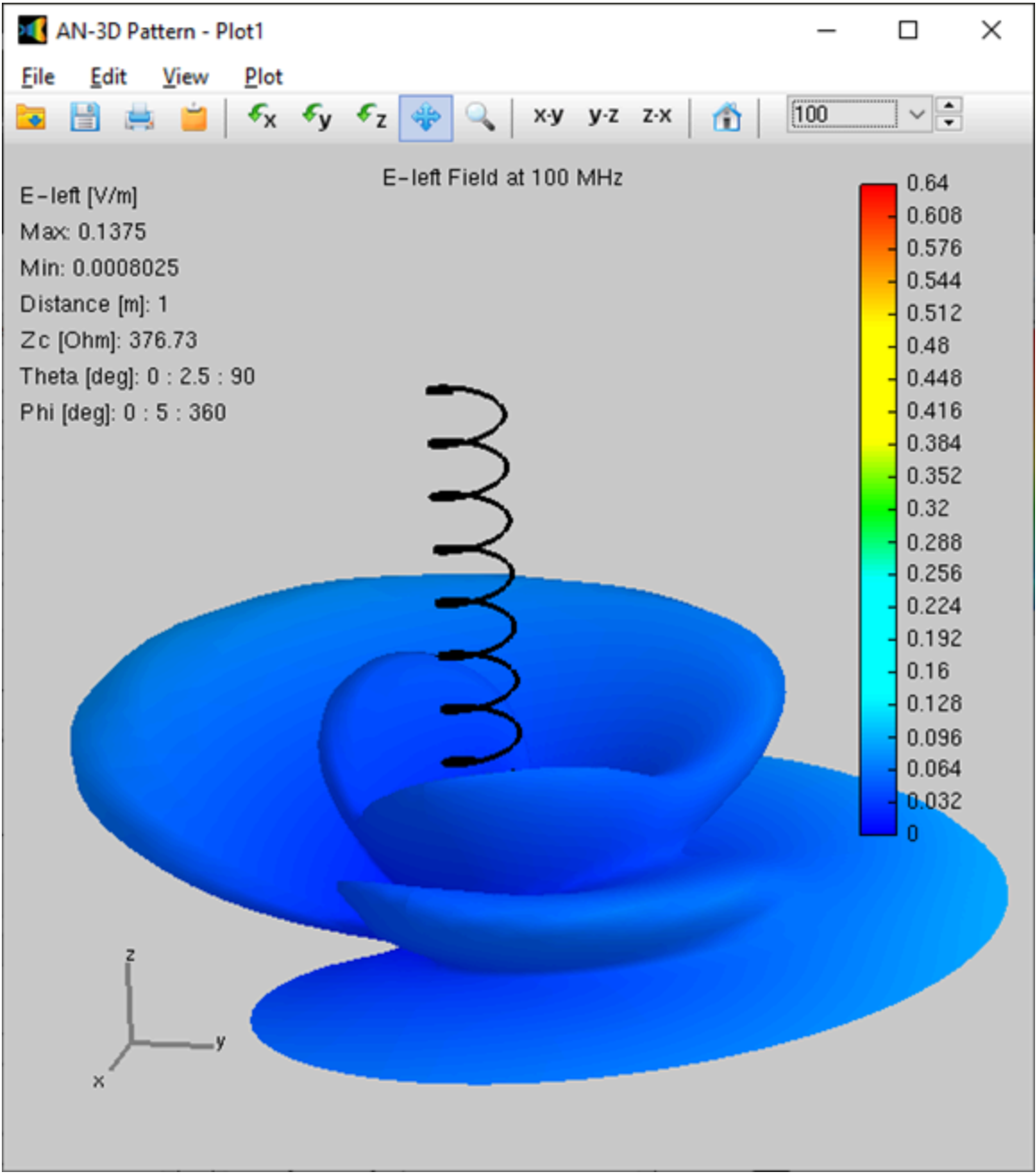


Fig. 4(c): Left-handed circularly polarized component of the far-field.

Key Features Demonstrated

- Curved segment modeling for helical structures
- Axial mode radiation characteristics
- Circular polarization analysis
- Ground plane integration
- Parametric comparison (right vs. left-handed)

The complete simulation showcases AN-SOF's capability to model complex antenna behavior with precise geometrical control.



About the Author

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ANTENNA SIMULATION ENGINEER & PHYSICS PH.D. With over 25 years of experience in Computational Electromagnetics, I'm a dedicated researcher specializing in antenna

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