Modeling Helix Antennas in Axial Radiation Mode Using AN-SOF

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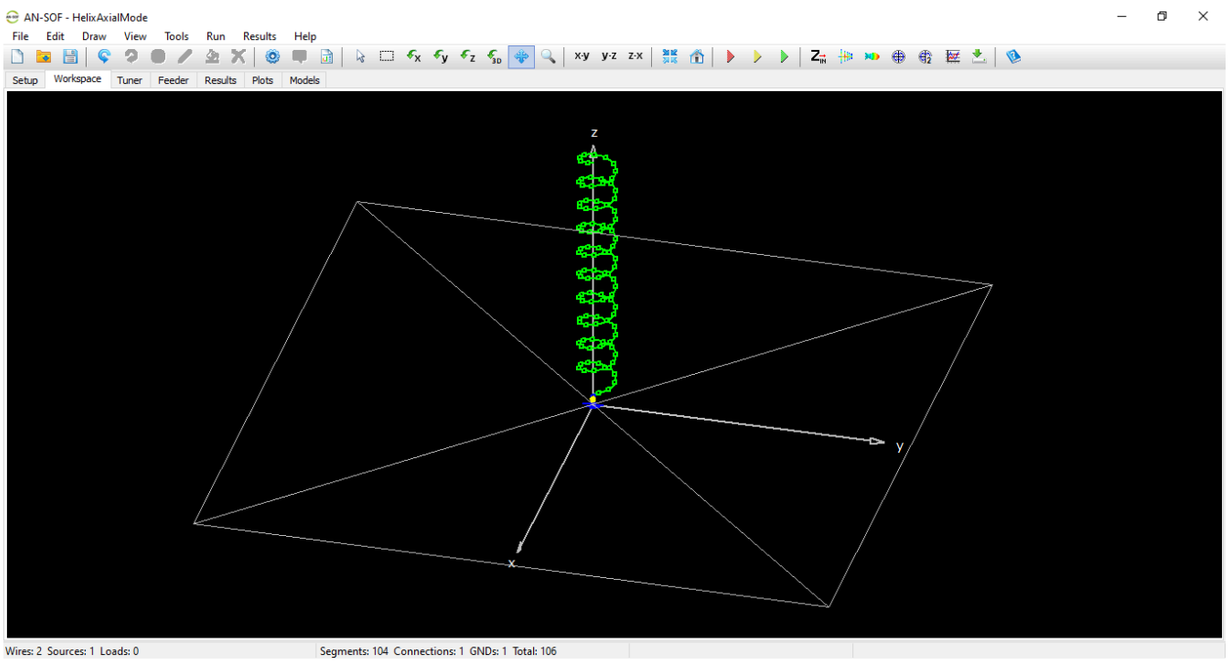
Perfect for Beginners: Quick Guide to Helix Antenna Simulation. Master axial-mode helix design in AN-SOF with this easy step-by-step tutorial. Learn ground plane setup, helix creation, and radiation pattern analysis. Start modeling professional antennas today!



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 tab > 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**

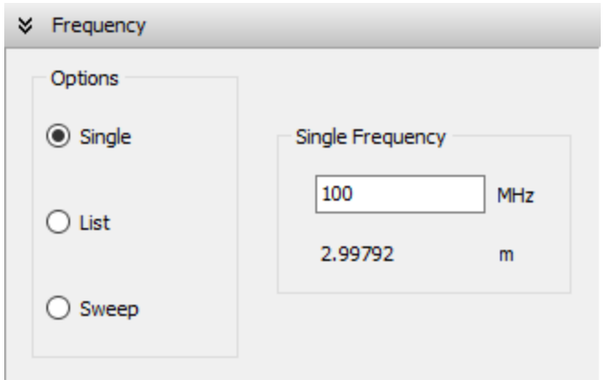


Fig. 1(a): Setting the operating frequency for the helix antenna.

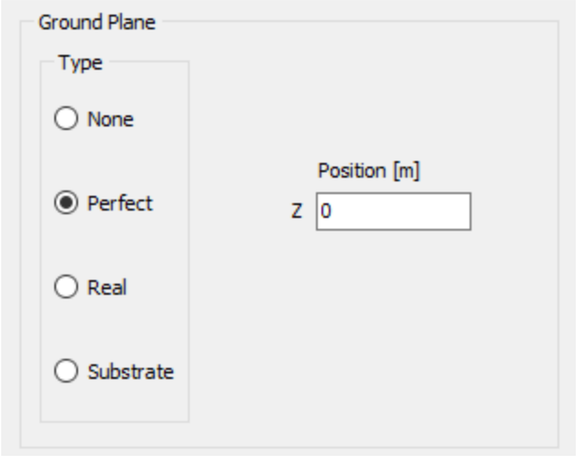


Fig. 1(b): Setting the ground plane for the helix antenna.

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)

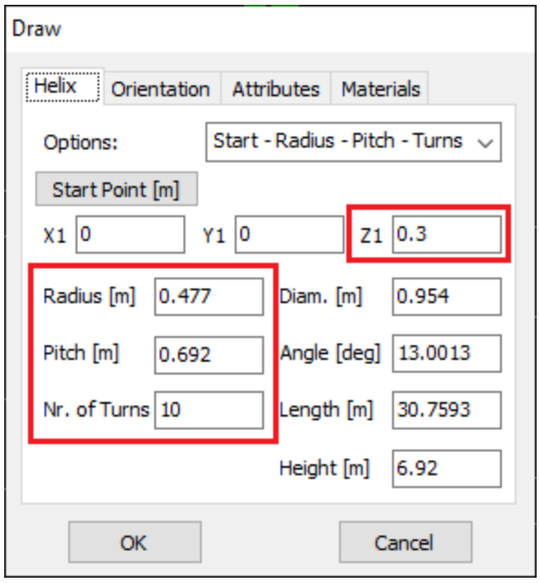


Fig. 2(a): Specifying the helix dimensions.

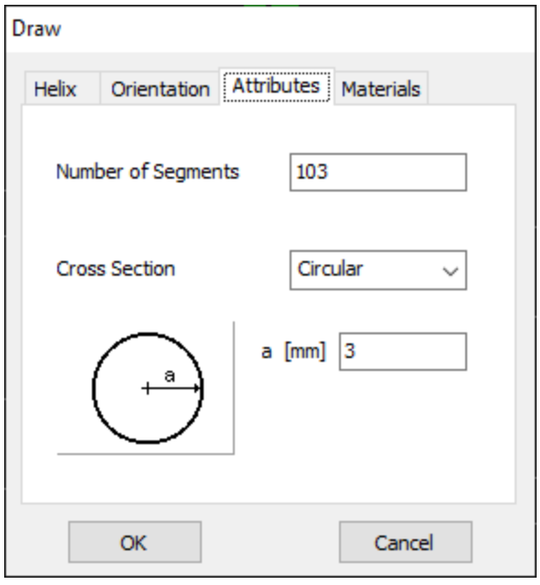


Fig. 2(b): Specifying the helix segmentation and cross-section.

Download Model

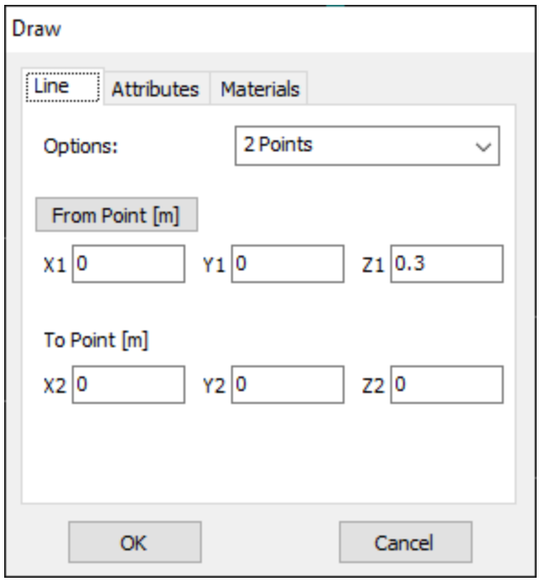


Fig. 3(a): Specifying the vertical wire that connects the helix to the ground plane.

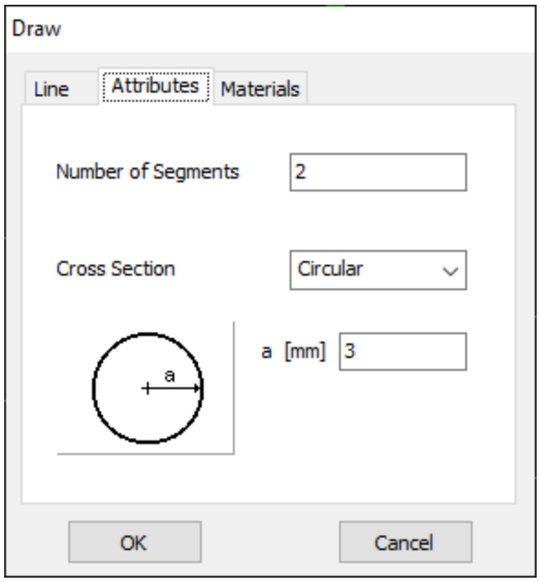


Fig. 3(b): Specifying the segments and cross-section for the vertical wire.

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

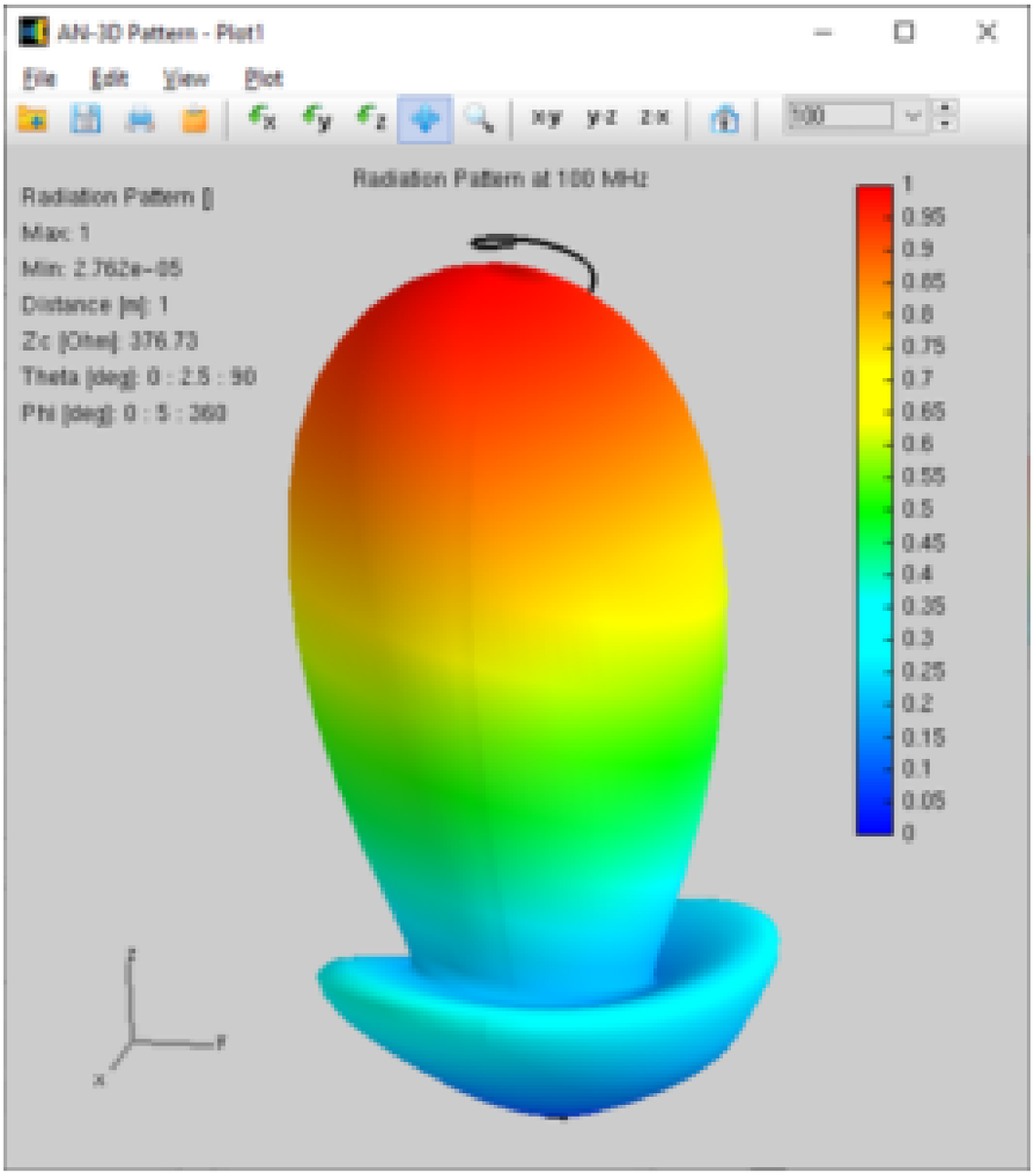


Fig. 4(a): Normalized radiation pattern of the helix.

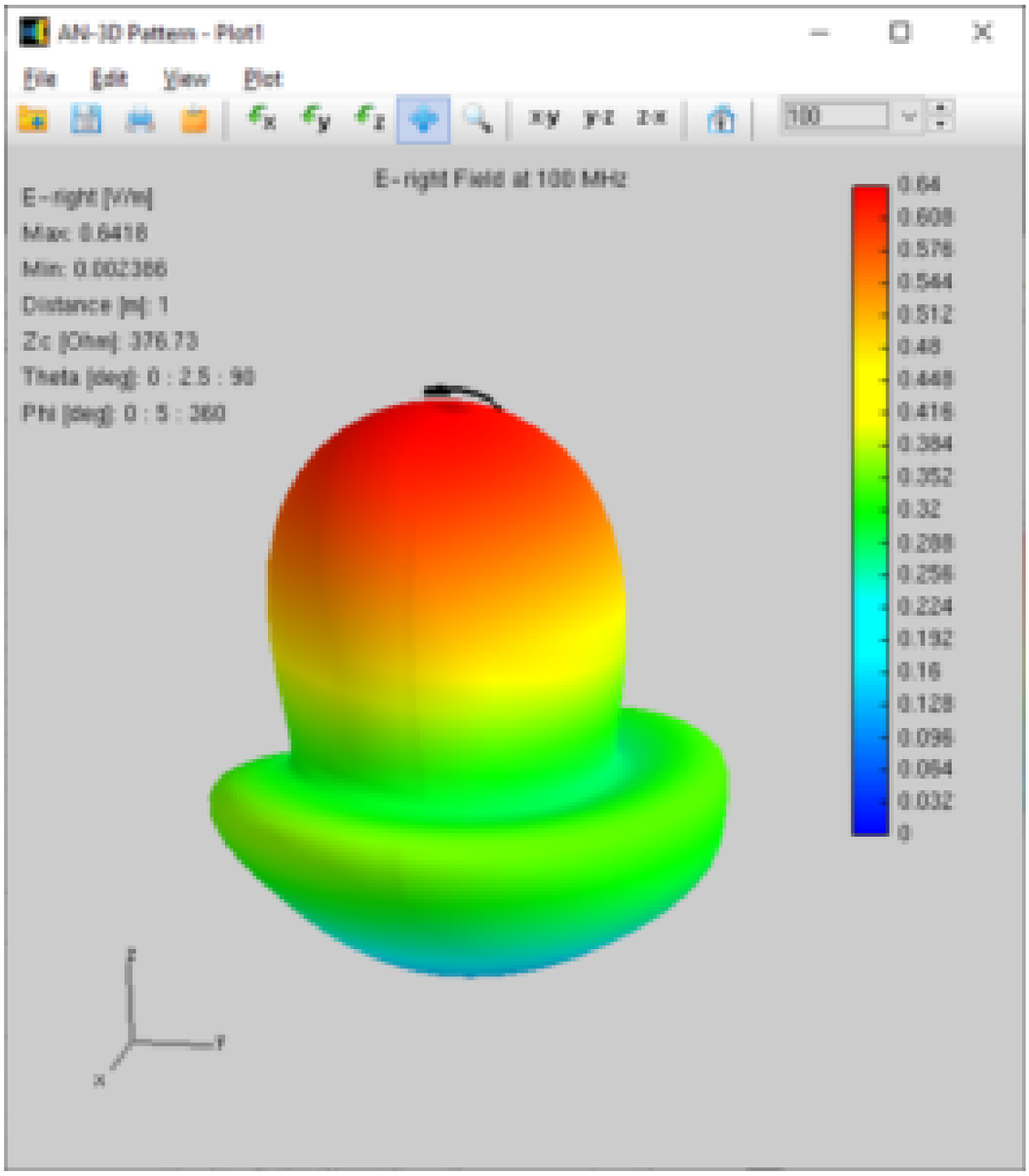


Fig. 4(b): Right-handed circularly polarized component of the far-field.

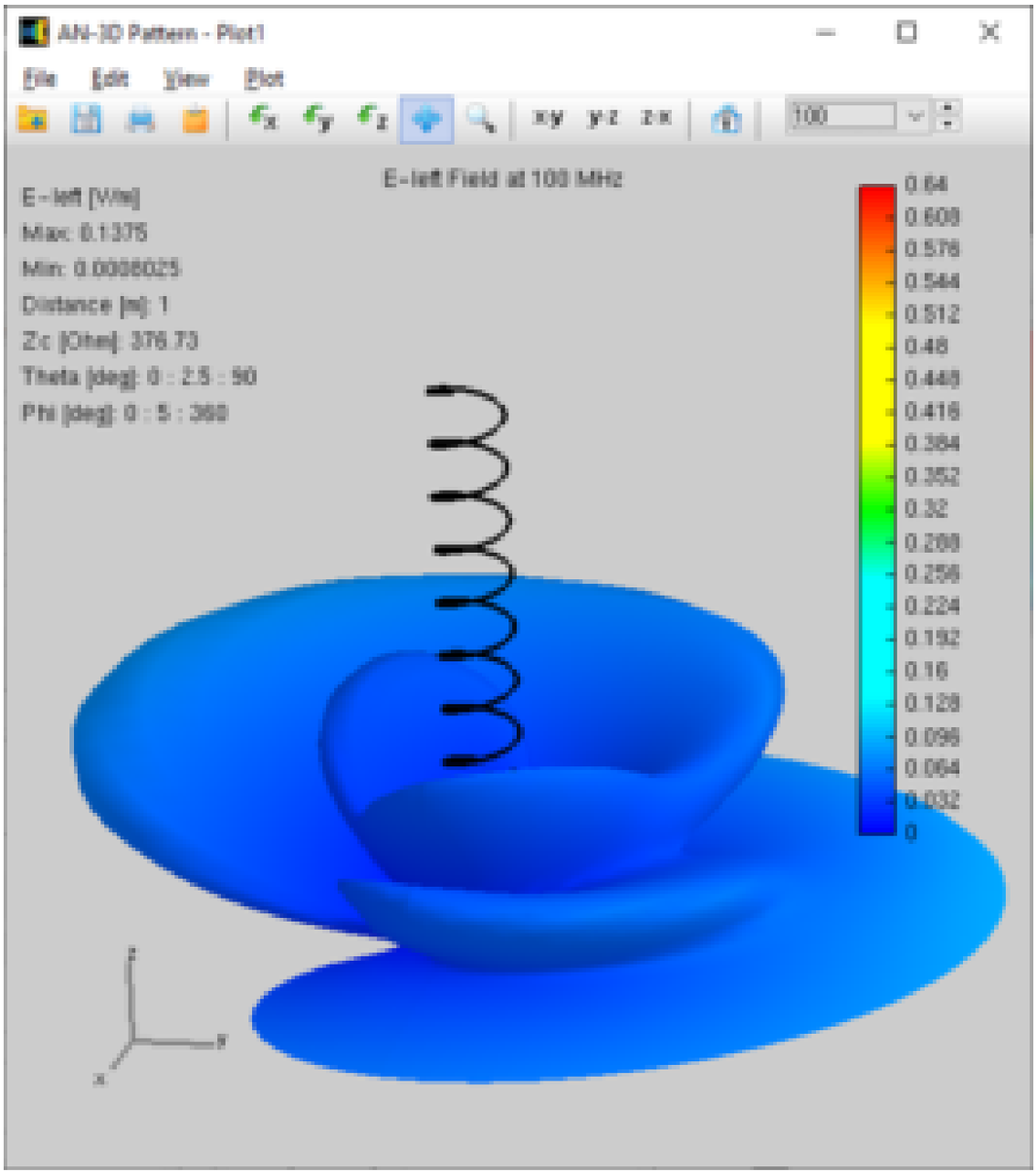


Fig. 4(c): Left-handed circularly polarized component of the far-field.

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.

See Also:

- **Efficient NOAA Satellite Signal Reception with the Quadrifilar Helix Antenna**
- **DIY Helix High Gain Directional Antenna: From Simulation to 3D Printing**

About the Author

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RF ENGINEER & PHYSICS PH.D. With 25+ years in Computational Electromagnetics, I'm a passionate researcher focused on antenna modeling and design. As Founder of Golden Engineering LLC, I develop accessible, high-performance simulation tools that help RF engineers optimize their designs, educators teach complex concepts, and hobbyists bring antenna projects to life.

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