Status report 3: Programmatic braided-wire shields in Discovery

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**Objective:** To develop a tool to programmatically generate braided-wire shield models using the Discovery scripting API and evaluate transfer impedance properties.

**Status summary:** Helical braids can be programmatically constructed along arbitrary paths defined by parametric functions or sets of cartesian points. An “equidistant” option is available to reduce geometry distortion introduced by path parameterization. Validation against a reference model is ongoing.

**Updates since previous report:**

* Braids can be built along paths specified by the user, rather than being restricted to the z-axis.
* An optional “equidistant” setting can be toggled to maintain equal spacing between wire strands when the braid is constructed along a path.
* Code is available on GitHub to facilitate version control.

**Validation status:** Results from complete simulations of reference and test cases continue to show moderate discrepancies for a Gaussian current pulse. A 1 MHz sine wave current is currently being simulated to help diagnose the issue.

**Parameterized paths:** An example of a parameterized path geometry is shown below.

A heart drawn on a grid

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**Figure 1:** Full (left) and zoomed (right) view of a cable braid constructed along a parameterized path.

A problem presented by this feature is that braid dimensions can become distorted, since the “speed” at which a point travels along a parameterized path can vary from location to location. To address this, an “equidistant” option is available that re-models the path as a series of points with a constant separation in space. This allows the specified dimensions of the braid to be maintained along the full path.

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**Figure 2:** Standard (left) and equidistant (right) parameterizations of a quartic curve. In the standard model, the rhombic gaps between carriers become longer further along the arms of the U-shape; in the equidistant model, the gap sizes remain the same.

**Next steps:**

* Evaluate simulation results for sine wave current.
* Make precise measurements of geometry along equidistant parametric paths to verify accuracy of equidistance algorithm.
* Add surface plotting for parameterized braids.
* Integrate new functionality with Discovery API script.

**GitHub repository:** <https://github.com/GriffinKowash/Cable-braids>

**References:**

Vance, E.F. (1974.) *Shielding effectiveness of braided wire shields*. Stanford Research Institute, Interaction Note 172.