Derivatives of Tengstrand's "3-2-1"

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Date Created: May 18,2024
Dimensions: 20cm tall
Materials Used: 3D-print, ABS plastic

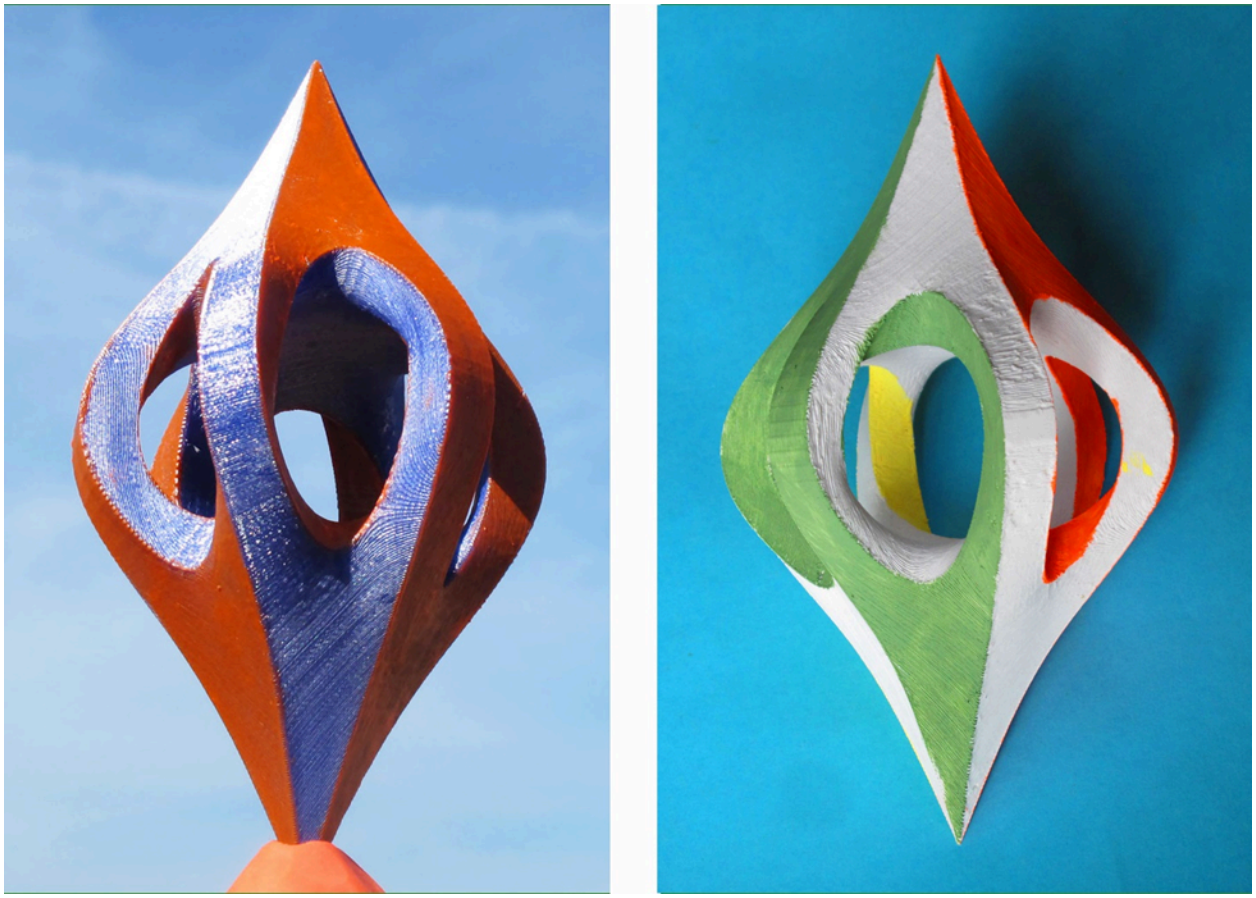
Statement

For several decades I have tried to turn mathematical models into small geometrical sculptures. Often, I start with a particularly intriguing sculpture by a recognized artist. For this exhibition I have been inspired by Tord Tengstrand's "3-2-1"-sculpture presented at Bridges 2020 [1]. His small model gets its name from the fact that it has three edges, two vertices, but only one single, wildly branching-out, smoothly connected face, that borders itself across the three edges. His sculpture is a handlebody of genus-2 that has three branches in the form of twisted 3-sided prisms. The three ribbon-like surface areas join in two junction patches inside the bi-pyramid structure. In my recent work I explored the structures that arise when I compose more than three prismatic branches and give those prisms more than just three sides.

Description

A particularly interesting case arises when I assemble six 4-sided prismatic branches into a bi-pyramid structure. Here, each individual edge-curves starts at one pyramid tip, makes four "down-up-down-up" passes past the central void, and then ends up at the same vertex that it started from. These six sharp edges partition the surface into six ribbon-like areas that start at one of the inner junction areas, also make four "down-up-down-up" passes, and then merge again in the same junction area, where they join with two other ribbon structures.

Depending on how the three edges starting from the top vertex are oriented with respect to the three edges starting from the bottom vertex, the resulting genus-5 handlebody may have just two "wild" Tengstrand "faces" when three of the six ribbons merge in the upper junction area, and the other three ribbons join in the lower junction patch. But, if one set of three edges is rotated by 60 degrees, one set of three ribbons merges in both junction areas; this prevents the other three ribbons from joining, and this sculpture ends up with a total four Tengstrand "faces."



“6-2-2” versus “6-2-4” Tengstrand Derivatives” 12cm x 25cm x 22cm tall

An interesting case arises when I assemble six 4-sided prismatic branches into a bi-pyramid structure. Each individual edge-curves makes four “down-up-down-up” passes past the central void and ends up at the same vertex that it started from. These six sharp edges partition the surface into six ribbon-like areas. Depending on how the three edges starting from the top vertex are oriented with respect to the three edges starting from the bottom vertex, the resulting genus-5 handlebody may have just two “wild” Tengstrand “faces” when three of the six ribbons merge in the upper junction area, and the other three ribbons join in the lower junction patch. But, if one set of three edges is rotated by 60° degrees, one set of three ribbons merges in both junction areas; this prevents the other three ribbons from joining, and this sculpture ends up with a total four Tengstrand “faces.”

Designer(s) Biography:

Carlo H. Sequin has been on the faculty of the EECS department at the University of California, Berkeley since 1977. He has been teaching computer science courses with a focus on computer graphics and computer-aided design.