How to Carve Three – Dimensional Rope

Introduction

Rope is an attention-grabbing feature of any wood carving, either as a border or an integral part of the carving. Rope adds depth and detail, especially if it includes curves and knots. Carving rope is a great exercise for a beginner carver to learn how to use knives and gouges to create a continuous concave shape. However, before the wood chips fly, the rope must be accurately laid out such that it looks realistic. Errors are more obvious because misaligned or misshaped strands in the rope can be compared to adjacent and correctly carved strands.

I have carved rope many times and used several different methods to lay out the rope: a paper template, a rubber hose template, a scale and divider and even free – hand. These methods worked well enough on a two-dimensional relief carving because misalignments in the strands could be "corrected" from side to side as the strand continued out of sight on the back side of the carving. When laying out curved rope on a three-dimensional carving, templates did not work in tight places and it was incredibly frustrating having to redraw the strand lines over and over to get them to look right.

When I was given an opportunity recently to carve more three – dimensional rope to be the handle on a tool box, I decided to take a more rigorous approach to laying out the rope and hopefully avoid the trial and error process. First I consulted all of the carving books and magazines that I had access to. I found many patterns that included rope but not enough direction or even helpful hints about laying out three – dimensional rope. An internet search yielded the same result. I did find several U-Tube videos about laying out straight, spiraled designs that resembled threaded rod more than rope. Therefore, I decided to develop the best (simplest and fastest) procedure for laying out three-dimensional rope and to document it so that others might use it and hopefully improve it.

Observations

As with any other carving project, the carver must become very familiar with the real subject. After inspecting several different kinds of rope that were available in my home, I noted that regardless of the type or size, all had the following characteristics:

Figure 1 Straight rope made from natural fibers

Figure 2 Curved rope made from synthetic fibers.

1) Rope includes three strands that are formed of many filaments of the rope material.
2) The diameter of each strand is exactly one half the diameter of the rope.

3) When laid out in a line on a flat surface and viewed from the side, the angle of each strand is 30 degrees from horizontal rising up to the left.
4) When viewed along an edge, each strand is linear as it spirals around the outer diameter of the rope.
5) When the rope is curved, the gap between strands on the outside of the curve expands while the gap between strands on the inside of the curve does not.

The procedure for laying out the strands in a rope carved in wood must incorporate all of these characteristics or the end result will not resemble real rope.

Theory

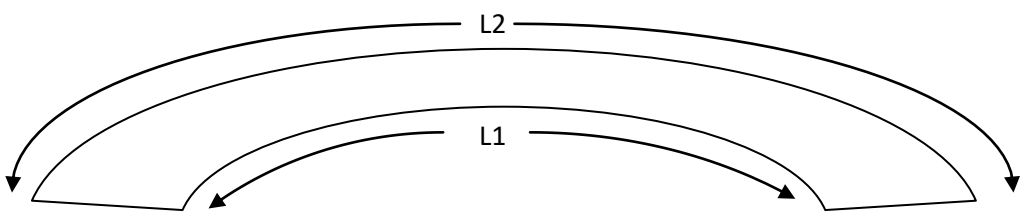
I will confess to following many complex paths before arriving at this procedure. But in the end, all of that geometry and algebra helped me to understand that rope is not all that complicated. Perhaps the most useful theorem is the one we have all heard a million times, "You can't push on a rope." As a length of rope is curved, the length of the outside of the curve becomes longer than the length of the inside of the curve. The strands on the outside of the curve separate and expand but the strands on the inside of the curve cannot compress – you really can't push on a rope. So it turns out that the most critical characteristic of curved rope is the ratio of the length of the outside of the curve to the length of the inside of the curve.

Procedure

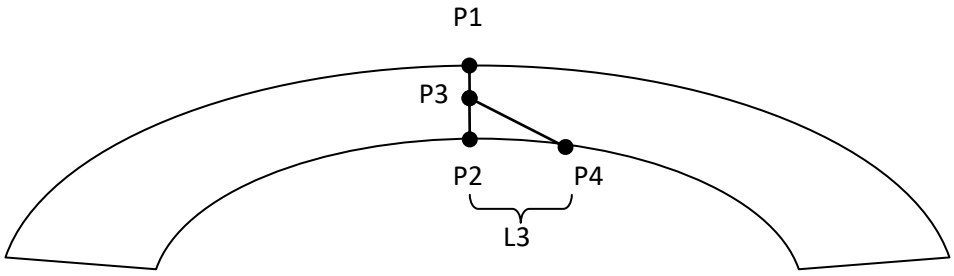
1) If the desired rope diameter is greater than the thickness of the rest of the carving, then wood must be glued up to a thickness slightly greater than the rope diameter.

Figure 3 Wood strips are glued up to a thickness just greater than the desired rope diameter.

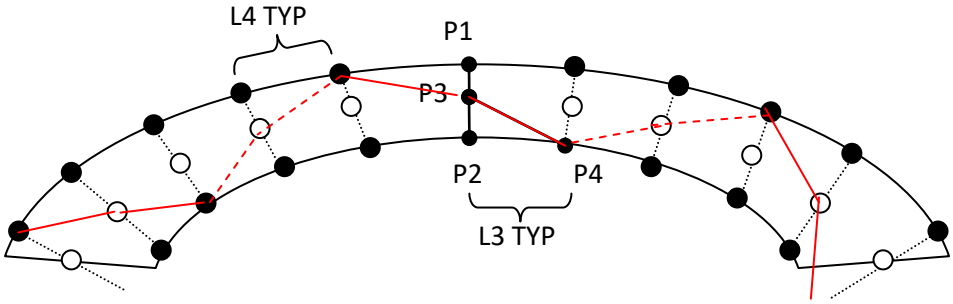
2) The rope should be rounded off to be very nearly circular before proceeding on with the lay-out.
3) Measure the length of the rope on the inside of the curve, L1.
4) Measure the length of the rope on the outside of the curve, L2.



5) Divide the outside length, L2 by the inside length, L1 to calculate the ratio of the lengths, A.
6) Pick a place on the rope with either no curvature or a place that can be assumed to straight for a very short distance, in this example the center of the handle.
7) Draw a line perpendicular to the rope at this point, P1 on the top to P2 on the bottom.
8) Find the center of this line and mark a point on the side of the rope, P3.
9) Draw a line from P3 at a 30-degree angle down to the right on the bottom of the rope. Make a mark at the bottom center of the rope on this line, P4.



10) Measure the distance from P2 to P4, L3.
11) Multiple the distance L3 by the ratio A that you calculated in Step 5, L4.
12) Starting at the point P1 that you marked on the top of the rope, mark points along the top of the rope separated by L4 to the end(s) of the curved part of the rope.
13) Starting at the point P4 that you marked on the bottom of the rope, mark points separated by the distance L3 to the end(s) of the curved part of the rope.
14) Align a straightedge with a P1 mark on the top of the rope with the mark directly below on the bottom of the rope. Using your eye, mark a point on the side of the rope halfway between the top and bottom points. You can mark all the points on one side of the rope before marking the points on the other side of the rope.



15) Using a flexible straight edge like a coated-fiber measuring tape, connect the dots that will define the linear edge of a strand from bottom to side to top to the other side and back to the bottom and so on to the end of the rope (the red line in the sketch above).

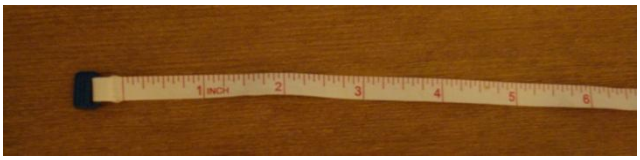


Figure 4 A coated fiber tape measure is flexible enough to follow the curve of the rope and rigid enough to draw the line that connects the dots.

16) Inspect the lines for uniformity of the strand widths and linearity of the spiraling lines. Linearity of the spiraling lines is the most likely error since the points on the side of the rope were just eye-balled in and might be slightly misaligned. This is a very simple problem to fix by just by re-drawing and straightening these short line segments.
17) Congratulate yourself on a job well-done if you successfully laid out the rope on your first try.

Carving the Rope

Carving rope begins with a knife or V-tool by deepening the lines between the strands. Bear in mind that there are several types of rope that are characterized be different strand shapes. For example, nautical rope tends to be tightly wound with shallow strand lines while mid-evil rope has more loosely wound strands. Whichever type of rope you want to carve, the challenge is then to consistently shape all three strands over the entire rope length. There are options in carving the strand surfaces too. Modern synthetic rope tends to have strands resembling threaded rod so a gouge with a sweep that matches the curvature of the strand will leave a very smooth strand. Antique rope made of natural fibers is much less smooth so a flat chisel might work best in leaving facets in the rope. If the rope is curved then it is likely there will be some very tight places on the inside of the curve. Your patience and perseverance will be rewarded when these places have been correctly carved and add greatly to the overall carving.

Figure 5 Carved rope handle for a tool box in cherry with a Tung oil finish.

Application

The simple procedure for laying out and carving rope that is defined here applies to any rope from straight to continuously-curved to rope with several different curves. The property that changes along the length of the rope that must be accommodated is the ratio of the lengths of outside to inside of the curve, A. As the rope curvature increases or decreases, so does the term A increase or decrease. The fact that A changes along a curve of rope is the reason why templates fail to provide accurate results.