Parallelism Analysis for fiber arms (steel and titanium)

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Abstract

Fiber arm samples from Sumitomo (Ti-6Al-4V coated black with Fluorine resin-based dry lube) and from England (steel, 1.480mm holes) were checked for parallelism using gauge pin used for shaft couplers.

Material

2 each steel and titanium fiber arms

2 each gauge pins (Vermont gauge p/n 141105890, 0.0589 Go gauge pin class x, as specified in shaft coupler drawing 10354812-G to use as a part of shaft coupler) (length: approximately 5cm)

Method

 Two gauge pins were inserted into the holes of a fiber arm (figure 1), and was placed under a microscope to take a picture. A Mathematica routine was developed which picks up the gauge pins as features of the picture, and linear fits were used to determine the slope of the gauge pin within the picture. The slopes were converted into degrees respect to the horizontal edge of the picture, then one was subtracted from the other to obtain the angle difference between the two gauge pins.



Figure 1: A fiber arm with 2 gauge pins

2) The same fiber arms were looked upon from the side to check how well the 2 pins would overlap each other.

Results

1) Titanium fiber arm #1: 0.02 degrees



2) Titanium fiber arm #2: 0.09 degrees



3) Steel fiber arm #1: 0.02 degrees



4) Steel fiber arm #2: 0.07 degrees



Conclusion

Both Titanium and Steel fiber arms are comparable in parallelism, however they both fail to meet the specification of 0.04 degrees (5 um over 6.5mm length specified in drawing no. 100101-0003) in 1 case out of 2. This result was discussed during PFI teleconference on September 21, and was considered functionally acceptable.