

ADC Prism Drive Error Analysis

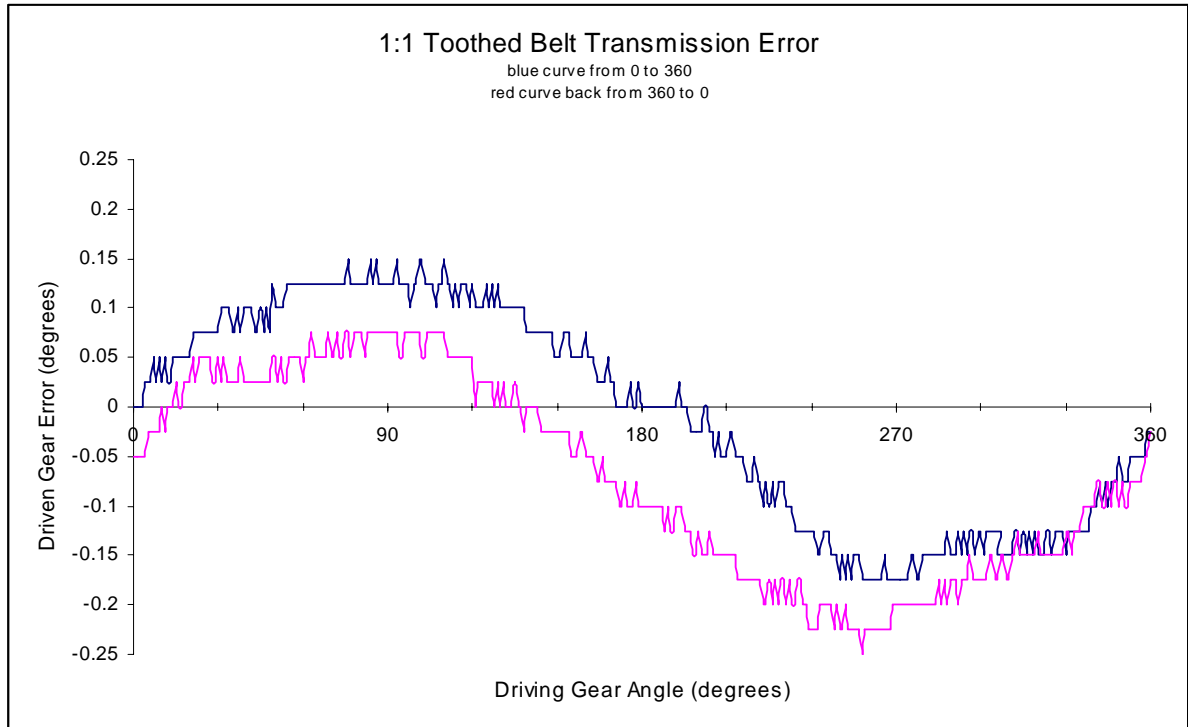
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The prism drive of the ADC will be implemented with a DC motor equipped with a 16 pulses per revolution incremental encoder and tacho-generator. Both the encoder and tacho-generator are built on the same mechanical axis of the motor.

The motor drives a 246:1 gear head unit. The gear head output drives the prism itself via a 1:1 toothed belt transmission. Additionally the driving toothed belt gear has a 24mm diameter cam for activating an initialization switch. Please refer to “FEROS ADC MECHANICAL DESIGN” page 10 for a schematic diagram.

The two main sources of positioning error are the 246:1 gear head and the 1:1 toothed belt transmission. We also have to consider the initialization switch uncertainty and the incremental encoder precision.

- I. The 246:1 gear head used is the Faulhaber model 16/7. The manufacturer specifies a backlash ≤ 1 degree. No periodic errors are specified.
- II. The 1:1 toothed belt transmission. Since no manufacturer data is available concerning the backlash and periodic errors of these gear-belt transmission system a simple setup was assembled for characterizing the performance. The peak error measured in a complete 0 to 360 and back to 0 degrees continuous cycle was 0.25 degrees, please refer to graph next page.
- III. Initialization switch uncertainty; the 24 mm diameter cam driving the Baumer 1um accuracy switch leads to +/- 0.01 to +/-0.005 degrees initialization uncertainty. The final performance will be highly dependent on the geometrical design of the cam and the mounting of the switch.
- IV. No data is supplied by Faulhaber regarding the incremental encoder precision.



Conclusion

The actual design will have a total maximum angular positioning error for each prism of 1.25 degrees. This is assuming that the encoder and the mechanics themselves will not introduce significant error.

Notes

- i. According to W. Eckert might be possible to order “zero” backlash 246:1 gear heads of the required dimensions at an extra cost, still to be verified with the manufacturer.
- ii. The measuring setup for the toothed belt transmission error uses two identical Heidenhain ROD 1020 incremental encoders with an accuracy of ± 0.00027 degrees and a resolution of 0.025 degrees.