Synchronous Belt Lifetime Optimisation

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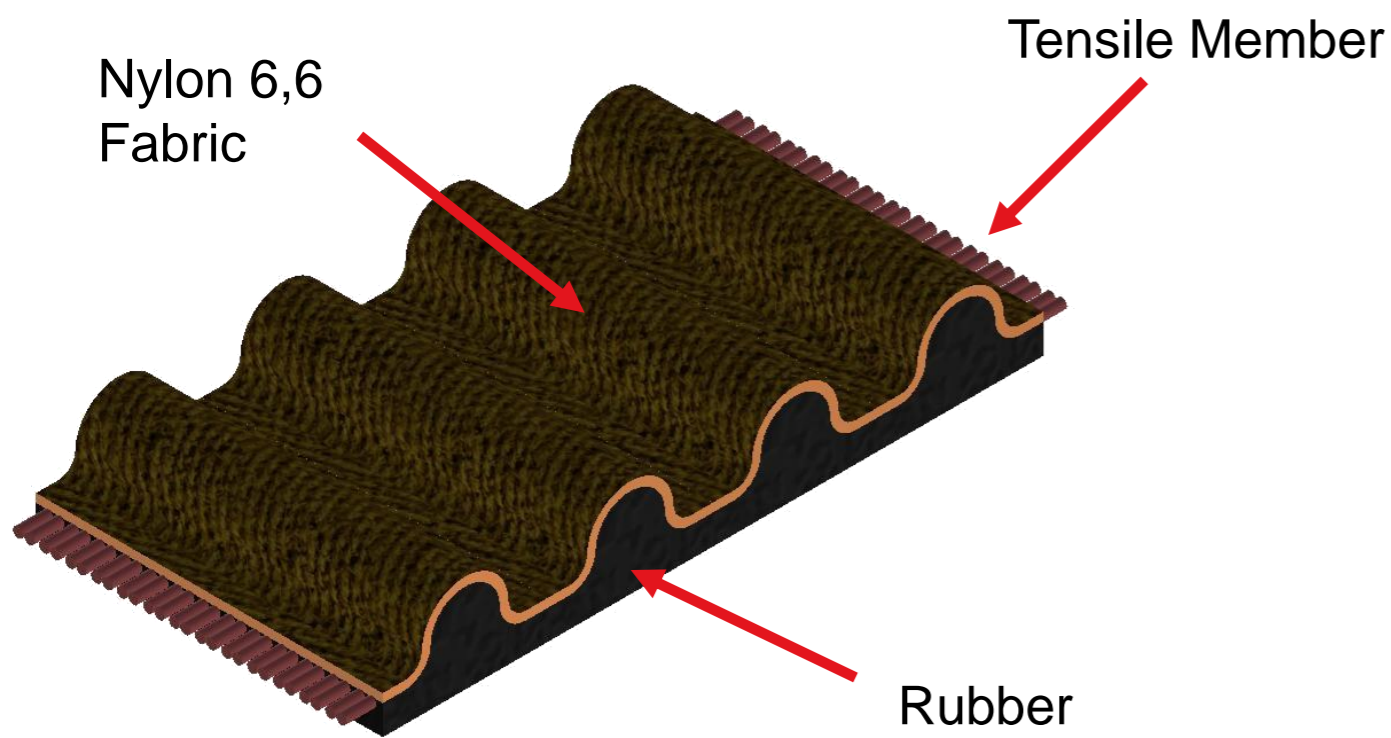
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Introduction

The Synchronous belt is used as a non-slip mechanical belt drive. They are typically found on vehicles as Cambelts as a means of synchronising valve timing.
The belt construction typically consists of the following:


Nylon 6,6 Fabric — Tensile Member — Rubber

Product Development

Requirements in synchronous drives are calling for higher modulus tensile members to withstand shock loads.
The use of high strength cords is causing a pitch increase in the finished belt product with historical testing highlighting increased levels of abrasion due to the increased pitch.
This can be remedied with tooling modifications, however at a significant cost.

Belt Pitch Increase
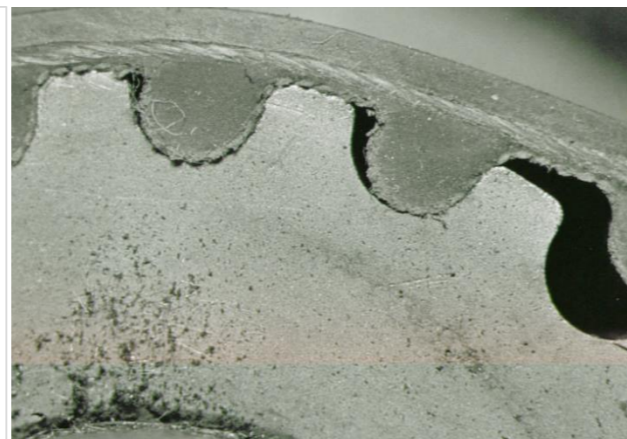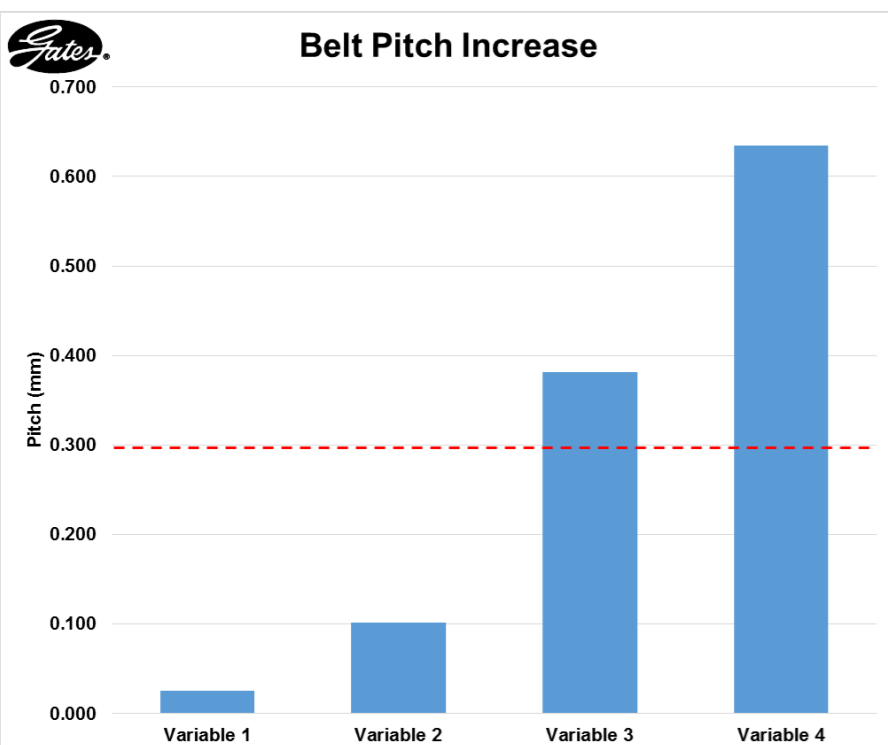
Investigation

Can the meshing behaviour be optimised through understanding of the belt modulus and correlation with pulley dimensions. Elimination of the meshing error could extend lifetime and increase efficiency of the drive system.

CIRCULAR PITCH
OUTSIDE DIAMETER
PITCH DIAMETER
P.L.D.
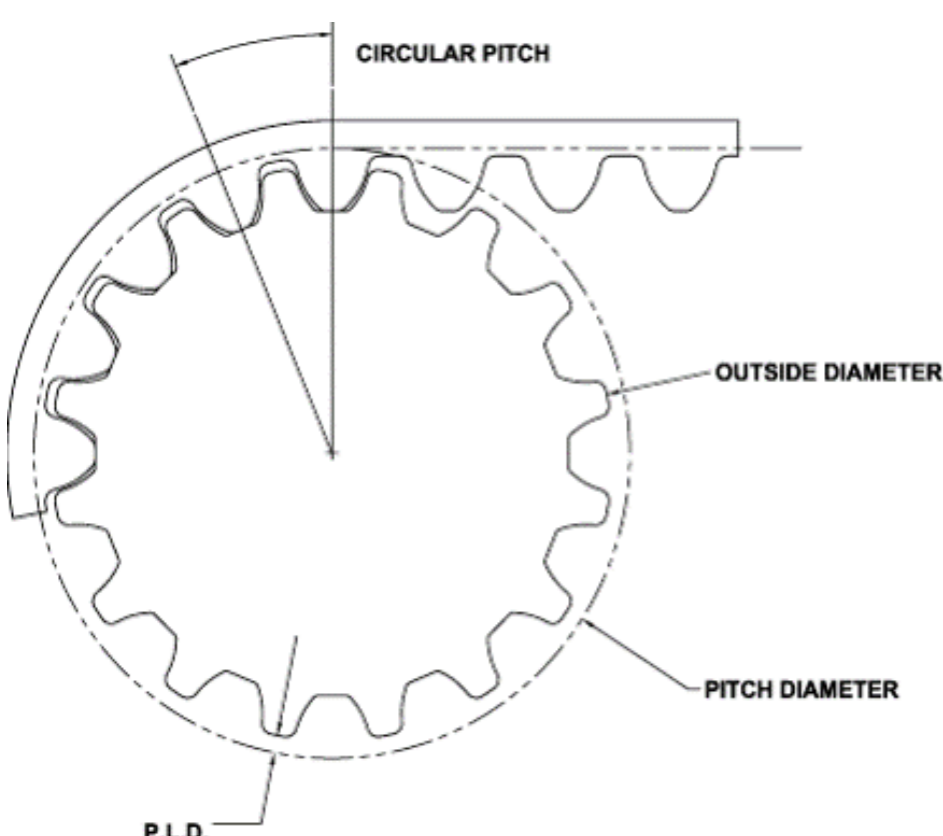
Initial Testing

Belt prototype measurements conducted to understand the belt stretch under load.
The initial data below will be used as part of belt pitch calculations with relation to the loads generated in the belt drive.

CD Measurement — Centre Distance (") vs Hub Load (N)
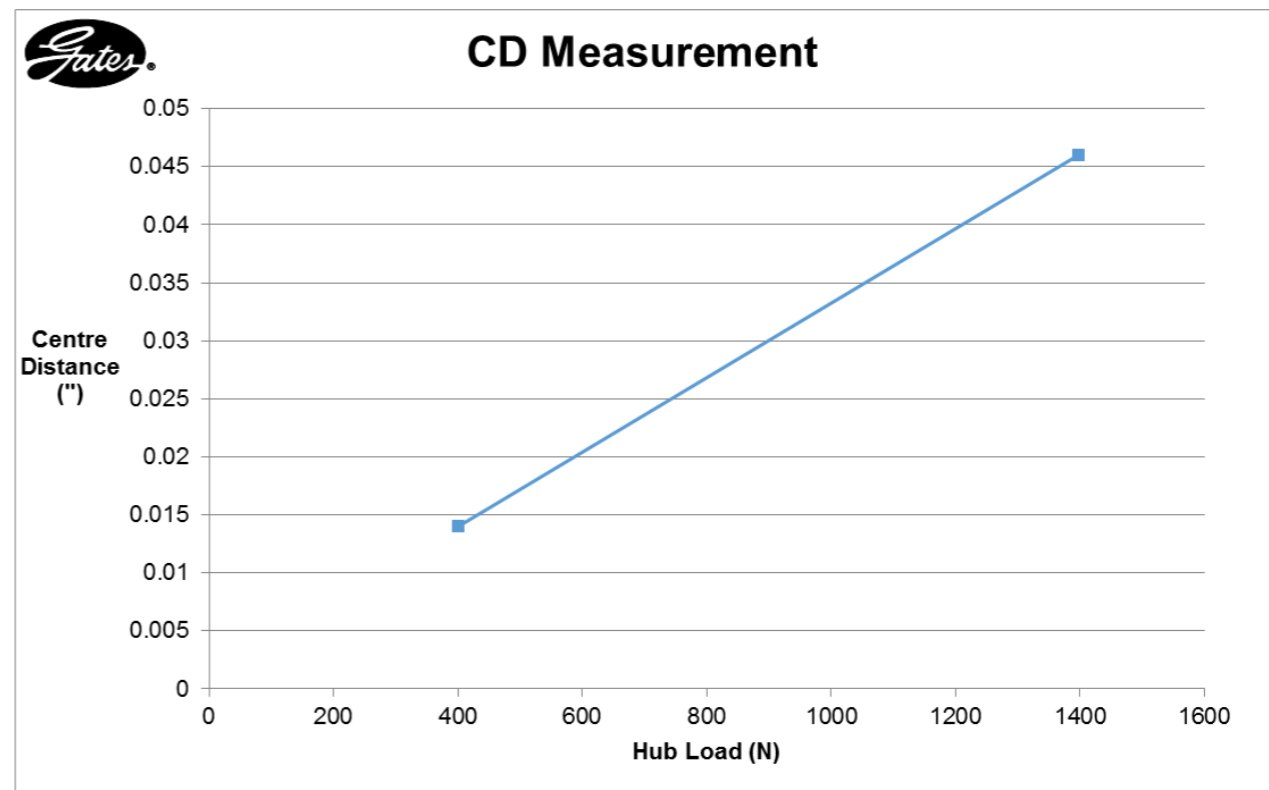
Next Stages

To understand the performance optimisation the following tasks will be carried out:
• Measurement of belt pitch (according to ISO13050)
• Calculation of pulley dimensions
• Manufacture of prototype pulleys
• Dynamic testing

Project Outcome

Dynamic testing will measure the belt performance with the following outputs:
• Belt running temperature
• Belt meshing (Stroboscope assisted)
• Lifetime to failure

Changes to belt lifetime and running temperatures will be interpreted into new design guidelines to ensure maximum efficiency from new belt drive systems.

Project Timeline

	Task Name	Duration	Start	Finish	Predecessor
1	Synchronous Belt Optimisation	130 days	Fri 04/11/16	Fri 05/05/17	
2	Project Approval	0 days	Fri 04/11/16	Fri 04/11/16	
3	Material Research	6 wks	Fri 04/11/16	Thu 15/12/16	2
4	Prototype Testing	5 wks	Fri 16/12/16	Thu 19/01/17	3
5	Assessment 1 - Poster	0 days	Fri 27/01/17	Fri 27/01/17	
6	Pulley Pitch Calculations	1 wk	Fri 27/01/17	Thu 02/02/17	5
7	Pulley Manufacture	2 wks	Fri 03/02/17	Thu 16/02/17	6
8	Belt Testing	6 wks	Fri 17/02/17	Thu 30/03/17	7
9	Short summary of findings	1 wk	Fri 31/03/17	Thu 06/04/17	8
10	Assessment 2 - Journal Article	0 days	Fri 07/04/17	Fri 07/04/17	
11	Evaluation of results	4 wks	Fri 07/04/17	Thu 04/05/17	10
12	Further testing	4 wks	Fri 07/04/17	Thu 04/05/17	11SS
13	Assessment 3 - Report	0 days	Fri 05/05/17	Fri 05/05/17	

Key References

•Gates Design Catalogue (Published Design Catalogues)
•Mectrol Timing Belt Theory (Published Design Catalogues)
•ISO13050:2014 – Synchronous Belt Drives – Metric pitch, curvilinear profile systems G,H,R and S, belts and pulleys