Dontyne Systems

www.dontynesystems.com

SIMULATIONS FOR HOBBING, CONTINUOUS GRINDING (WITH DRESSING), SHAPING, SHAVING, PROFILE GRINDING, SKIVING, HONING, END MILL OR FACE MILL, FORGING, INJECTION MOULDING.

MACHINE CENTRE

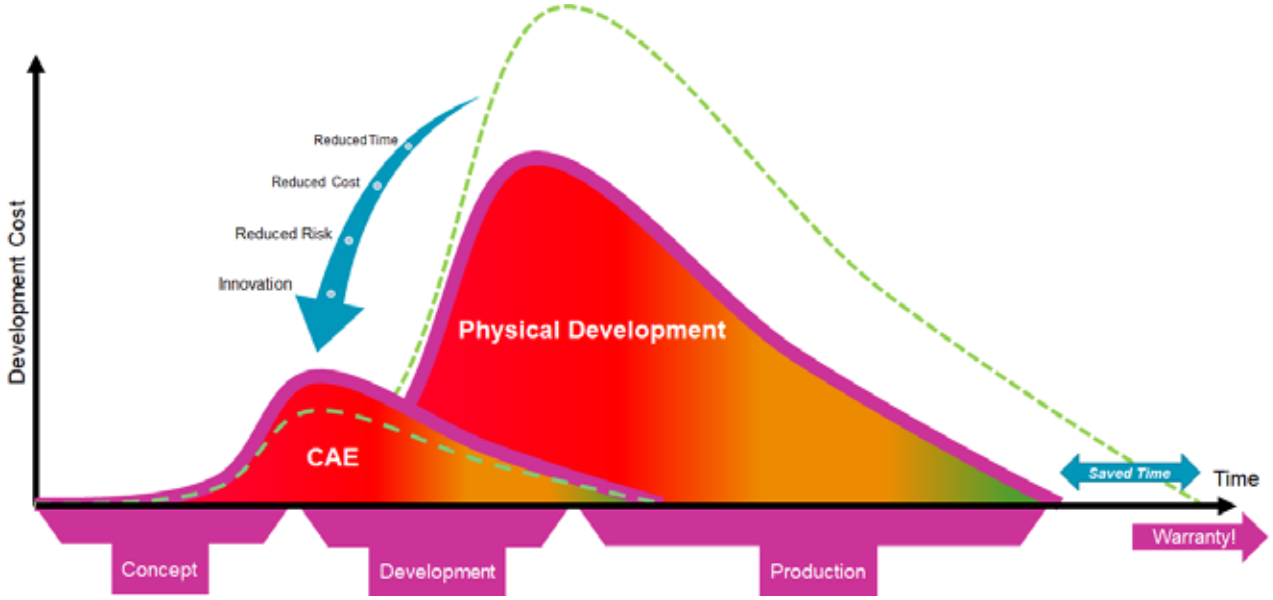
RELEASE 5.8

Dontyne Systems

Dr. Michael Fish,
Director & Co-Founder,
Dontyne Systems Ltd

We have now been successfully developing and marketing the Machine Centre module in our Gear Production Suite for over 17 years now. We can offer this module in a stand alone capacity or it can be integrated to other gearbox design systems. This is generating many new customers in our traditional markets of UK, USA, and Japan and we think this module will be of special interest to our new markets in India, South Korea, and Taiwan. We see great potential for its use in gear manufacturing centres in Eastern Europe, Vietnam, and Thailand.

It has been designed to integrate with gearbox design software. The GPS represents a good platform for designers and manufacturers to collaborate on a project to check and correct for problems before committing resources. The principle is being widely acknowledged now in the industry and our collaborations in interfacing to gearbox Design tools from Romax Technology, Ricardo UK, and MESYS AG is enabling a wider range of users access to the functionality.



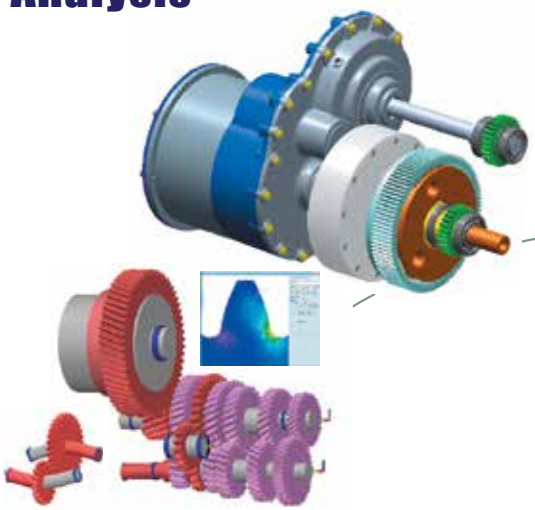
There are considerable savings in cost and risk in defining and checking manufacturing at design stage

Dontyne Systems and Gears continue to develop the software so that it can be integrated to a closed loop system involving third party software and machines following the Industry 4.0 principle. We also continue to develop and offer our own inspection and testing solutions to industry for complete production solutions. We look forward to discussing your requirement in the near future.

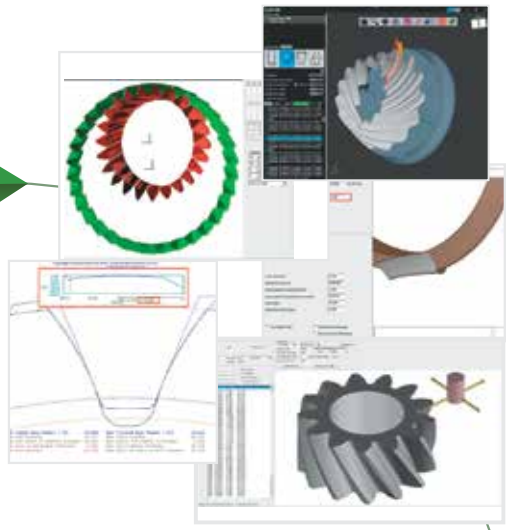
Dr. Michael Fish,
Director & Co-Founder,
Dontyne Systems Ltd

CLOSED LOOP GEAR PRODUCTION

Gear Design And Analysis



Tool Design And Machine Code

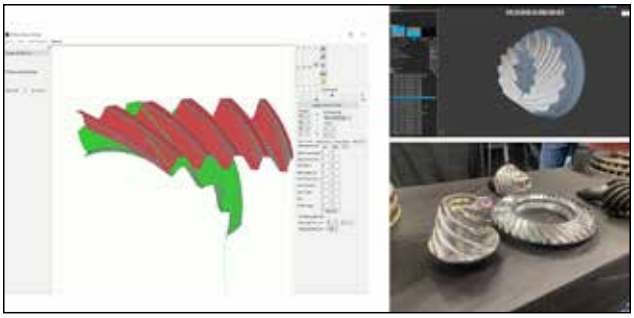


Machine Interfacing

Testing And Reporting

LATEST DEVELOPMENTS

HYPOID PRODUCTION ON 5-AXIS FOR MOTOR SPORT

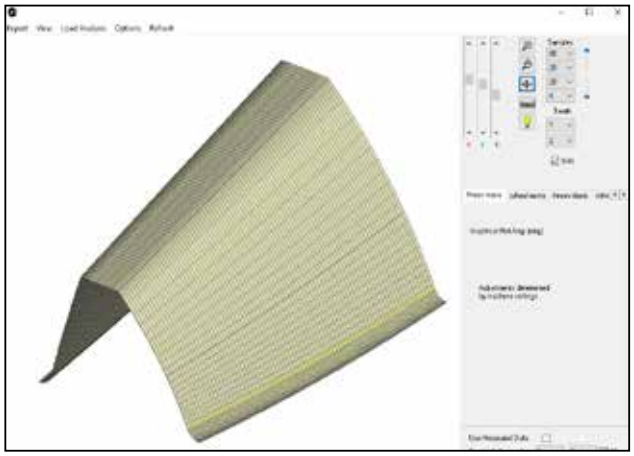


Rapid design and manufacture of Hypoid gears in-house by Tubeworks for the US motor sport

This intuitive hypoid design tool allows flexible design options and ensures complete conjugacy of the teeth through the mesh cycle before the appropriate micro geometry is applied, and has demonstrated immediate success. After meeting at PRI 2022, Tubeworks, based in USA and involved in motor sport, has become an early adopter of our Hypoid software design package. The CAD file can be exported to any CAM package or, for a more secure approach, the G-Code can be automatically generated from the designed surface using our GPS CAM module. They were able to produce components in house quickly and at low cost. Jayson Miles, CEO of Tubeworks commented "This has been a dramatic improvement on our previous approach using gear functions in our CAD system. Not only does it allow more design flexibility meaning we can optimise our design, but we can roll check the contact in seconds to ensure it is constant over the mesh cycle. The software has helped reduce our development cycle for hypoids from weeks to days."

DISH CUTTER SIMULATION FOR CONIFLEX® STRAIGHT BEVEL PRODUCTION ON 5-AXIS CNC MACHINES

In collaboration with Collins Aerospace based in Wolverhampton, UK, we have developed a dish cutter simulation for the fast production of Coniflex® bevel forms on 5-Axis using our GPS CAM system. This approach uses a fixed tool so it is not as versatile as the End Mill option but does allow more rapid production and higher volumes. We have been able to validate the result by producing test pieces on the Okuma at our Dontyne Gears facility in Washington UK.



Model of Coniflex®straight bevel created using GPS design tools

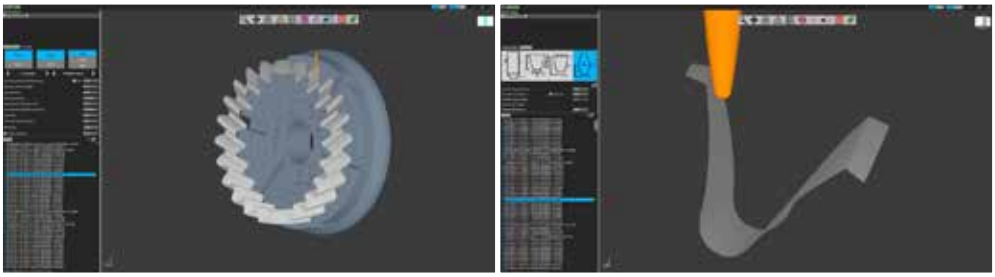
Simulation of dish cutter process in GPS CAM

Coniflex® is a registered trademark of The Gleason Works

GPS CAM

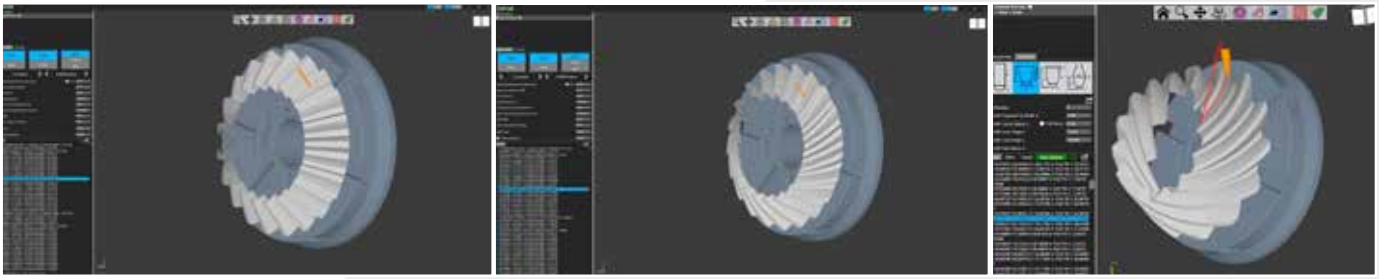
The 5-Axis simulation is greatly improved in GPS 5.8 and has a specific term GPS CAM. Embedded in GPS to automatically calculate and export the G-Code for the tooth cutting safely, this will be of special interest to gear manufacturers not able to cut gears cost effectively on dedicated equipment using fixed tooling. It has been quickly adopted by sectors needing fast, flexible turn around such as aerospace and motor sport. The system can simulate fixed tool production methods for larger scale or fast production. A detailed presentation is available on our YouTube Channel.

The system can be used by a machine operator to establish the optimum cutting parameters for both the roughing and finishing cycle. As with all simulations in the Machine Centre, the strength of using it integrated with GPS design tools is that any change to the generated form required by the cutting technique or tooling restrictions can be assessed and corrected by the designer before cutting metal.



Tool selection and machine settings can be varied for geometry imported from GPS for multiple operations

A range of gear geometries once designed and checked using Loaded Tooth Contact Analysis (LTCA) functions in GPS can be transferred to the GPS CAM interface.



A range of gear geometries

There are special features of the software to enable quick development in a user friendly interface.

Additional features such as G-code playback, stock plot, and rotary table

MACHINE CENTRE

AUTOMATIC TOOL DESIGN FOR GEAR FORM

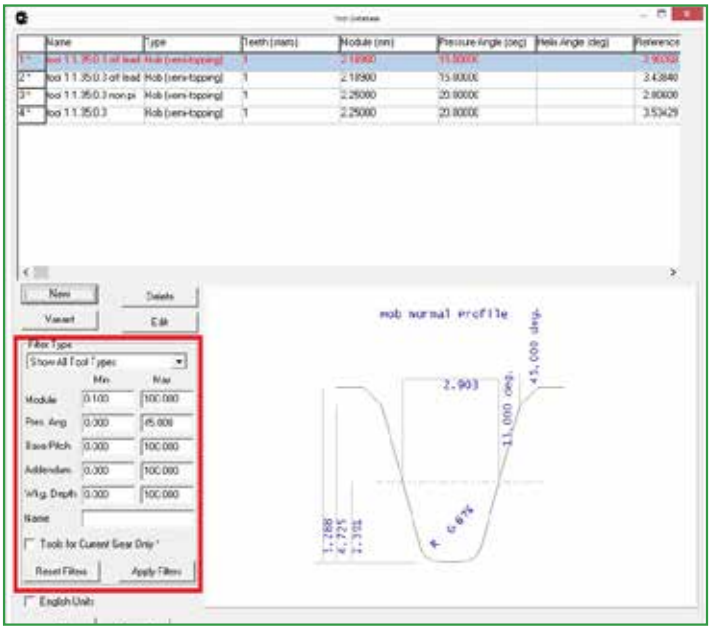
Gear hobbing generated profile to check tool design

FEATURES INCLUDE :-

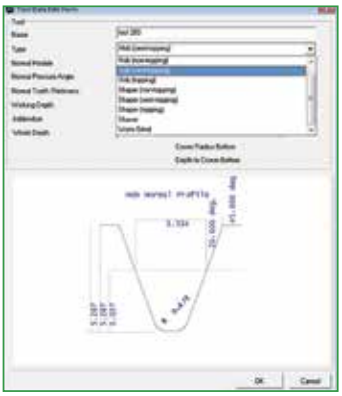
- Tool design
- Tool database
- Simulation of profile generation and micro geometry
- Analysis of max/min tolerances on generated profile
- Protuberance and short lead hobbing techniques on profile
- Use tool generated profile in bending stress calculation for accurate rating

GENERATE GEAR FROM TOOL DATABASE

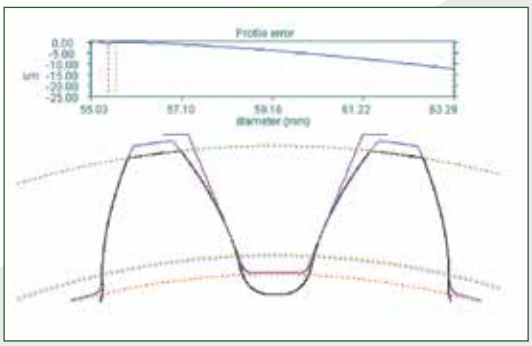
Tool database with filter system



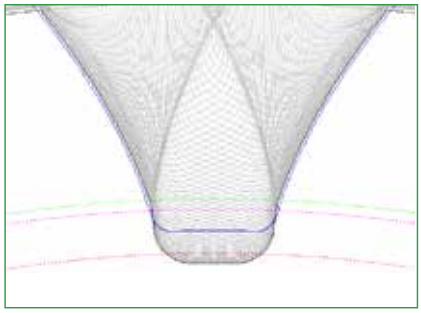
Define new tool



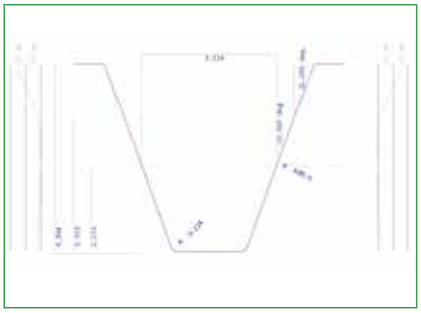
Profile error calculated from existing tooling



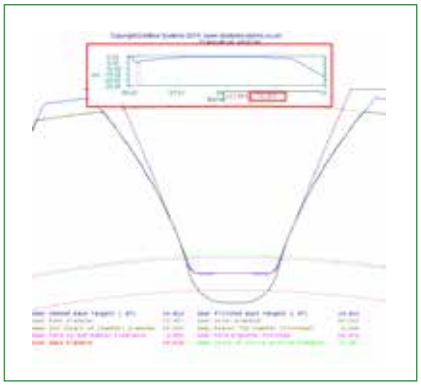
HOB & CONTINUOUS GRIND (WITH DRESSING)



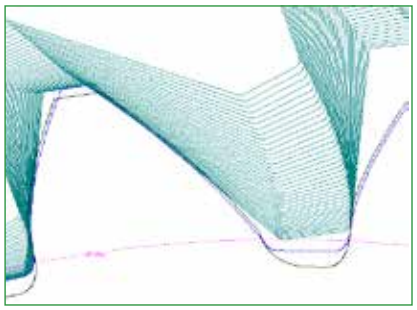
Hob roll out diagram including stock allowance and tolerancing



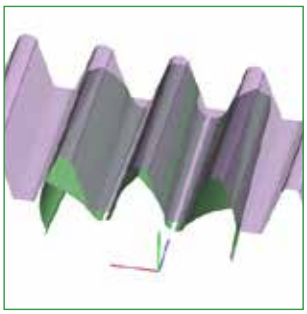
Define micro-geometry on dressing tool



Grinding simulation shows profile modification on gear with break out and chamfer



Asymmetric and non-involute tool design and roll-out check

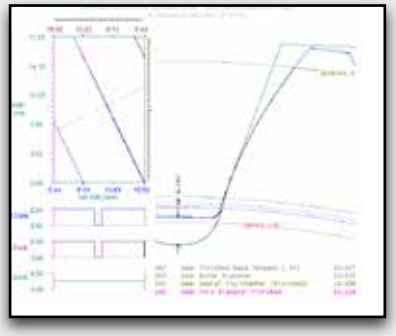


Rack generation of tool for beveloid gear including non-integer design

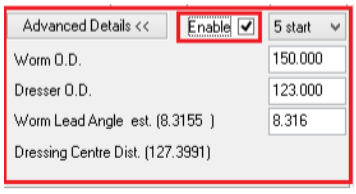
ADVANCED FUNCTIONS

Force Balancing

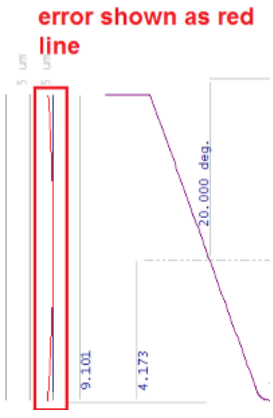
Accurate modelling of the manufacturing processes allows automatic tool design, including assessment of the effects of tolerancing, prior to cutting metal.

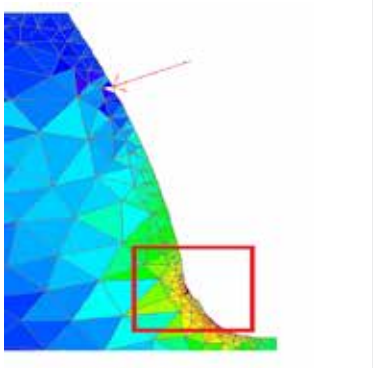


Force Balancing



Modelling the effects of small grinding worm diameter and multiple threads for higher accuracy model.

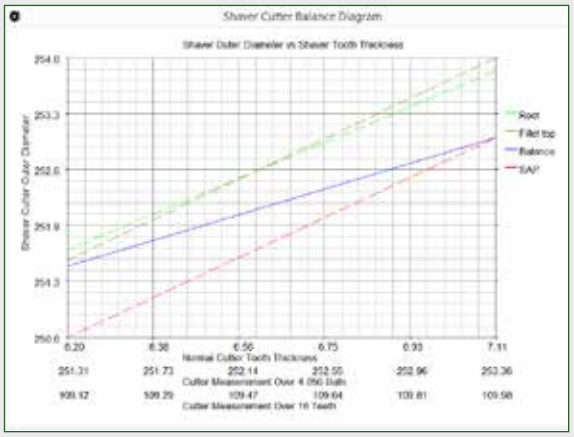




FE analysis function enable engineers to assess potential problems such as stress concentration due to a grinding notch in gear fillet.

SHAVING

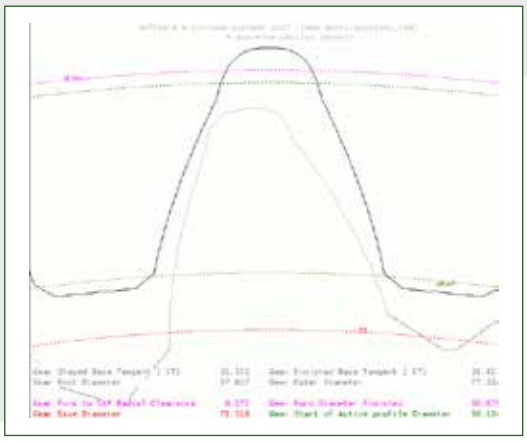
Protuberance for Shaper Cutters



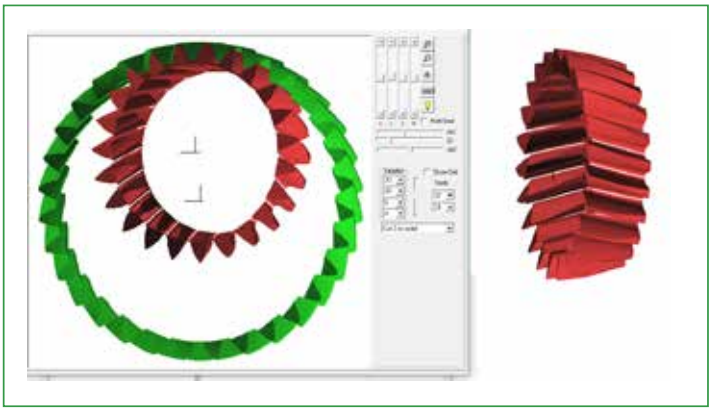
As the tooth thickness is reduced with sharpening along the x axis, the blue line depicts the outer diameter reduction required to maintain force balance. User can click on diagram to create optimum design.

SHAPING, SKIVING, AND HONING

Shaving cutter sharpening Diagram



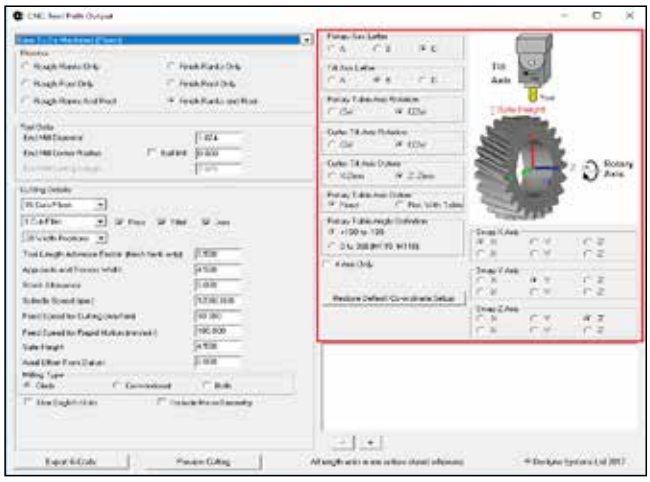
Options added to Machine Centre module with full tool definition.

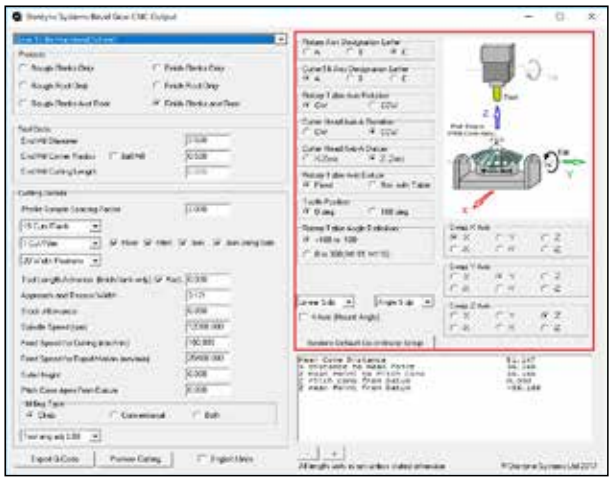


PROFILE/THREAD GRINDING

New profile form grinding simulation introduced, which includes the application of micro-geometry.

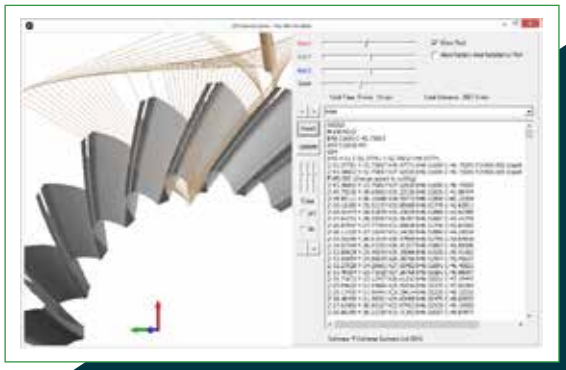
MULTI AXIS – END MILL AND FACE MILL





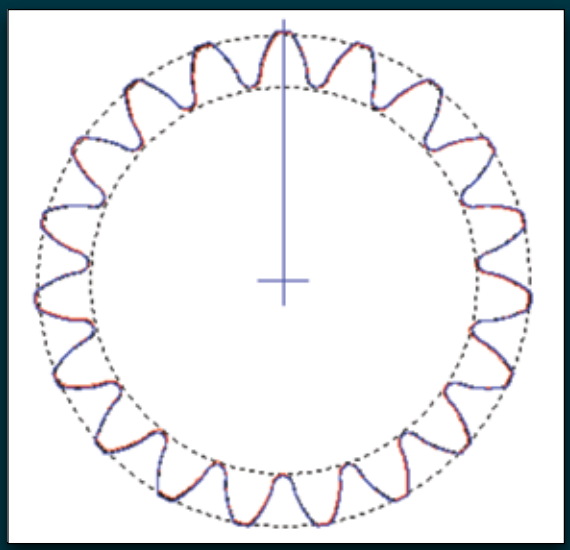
Define 5-Axis movement and cutting strategy for Spur, Helical and Bevel

Tool calculation and G-code export for 5-axis production.



FORMING – FORGING,ROLLING, INJECTION MOLDING

Tool corrected by mapping error to previous tool surface for higher accuracy tool in a 2D plane

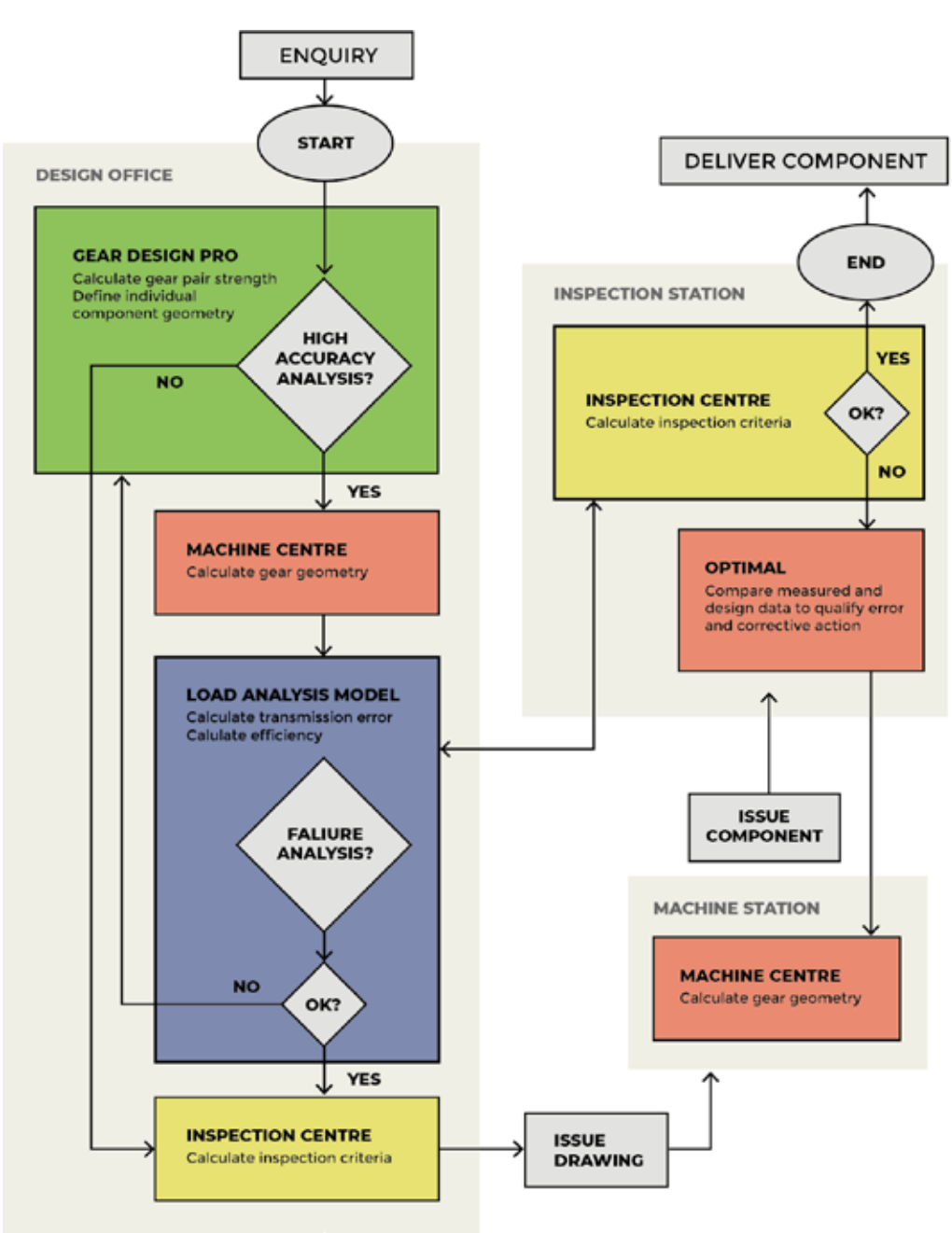


Invert errors on mould

Invert errors on mould

OPTIMAL

Each module is a powerful tool in it's own right and can be individually licensed, but there is additional benefit to utilising all modules together. Data gathered at the machining and inspection stage can be compared to the design specification and the contact models by networking in-house or even via Internet using the Gear Production Suite as a process control platform. The data can be used for many purposes other than direct design such as correct tooling or machining errors (see opposite). The software can be used to optimise both product quality and performance giving direct return on investment.



GEAR PRODUCTION SUITE (Key)

Gear Design Pro

Design and rate gear components using common standards

Load Analysis Model

Simulate operating characteristics of gear pairs

Inspection Centre

Define component quality and simulate testing procedure

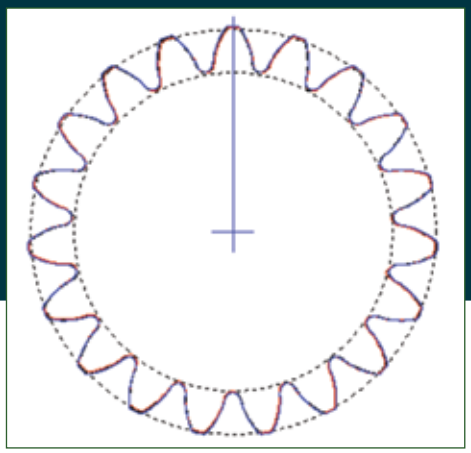
Machine Centre

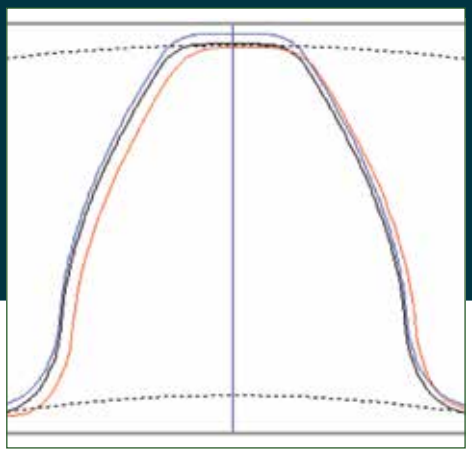
Calculation of component form based on machine and tool settings

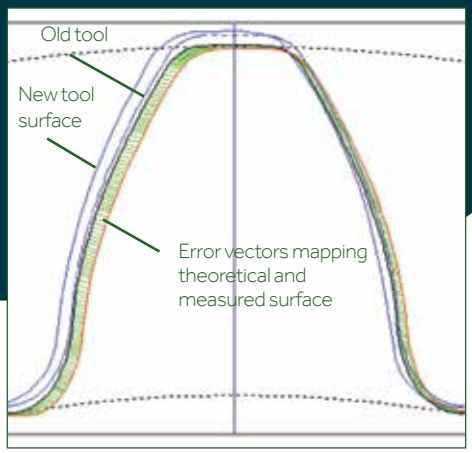
Optimal

Calculate optimum machine and tool settings

Tool corrected by mapping error to previous tool surface for higher accuracy tool in a 2D plane







Before Calculation

The theoretical surface (black) and tool surface (blue) can be designed in Gear Production Suite or imported from CAD, measured data imported from measuring equipment

After Calculation

The error between theoretical and measured surface is mapped by a vector (green) and used to create modified tool surface

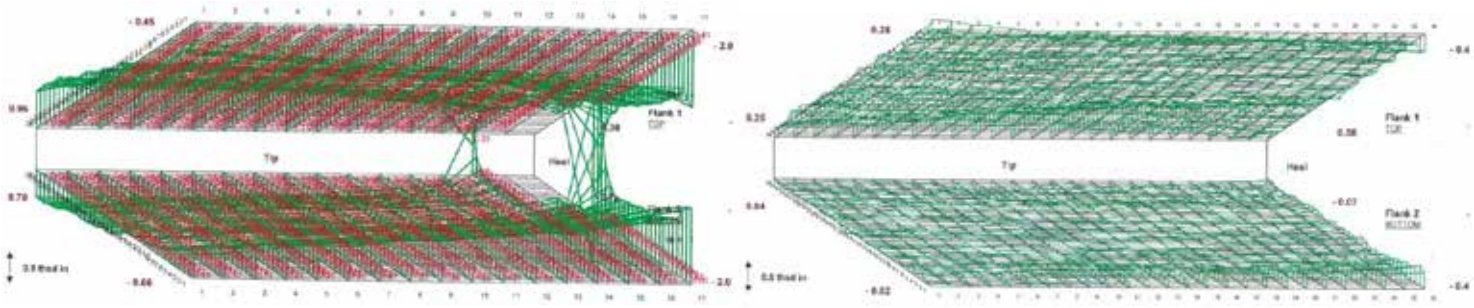
The calculation can be applied to multiple layers or a complete surface model for corrections to a 3D volume

Distorted gear due to shrinkage

Invert errors on mould

Improved quality gear

Optimal - Tooth measurements before and after correction



Before

After

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