Robust Transmission Design through Automated Optimization of Virtual Prototypes

Romax Technology, the U.K.-based supplier of virtual transmission simulation software and technical consultancy services, is automating the design iteration optimization process to allow companies to be faster to market with the highest quality, most robust geared products.

"RomaxDesigner has the closed-loop analytical techniques required for the addition of optimization algorithms to enable the software to search the entire design space for the optimal 'right first time' solution," says Dr. Peter Poon, managing director. "Romax can run hundreds of simulated tests, reducing the need for costly prototype hardware and lengthy, expensive development test programs."

Romax offers a suite of fully integrated software modules for the durability and NVH dynamic analysis of all types of parallel shaft, planetary and perpendicular

axle power transmission systems to ISO and AGMA standards. Global customers are supported by teams of software developers and technical specialists to smooth the implementation of Romax into organizations.

According to Poon, the simulation models accurately predict all the system deflections under all loading conditions that have an influence on gear mesh misalignment. Automated optimization of the macro- and micro-geometry of spur and helical gears maximizes durability, improves smoothness of operation to reduce gear noise, and reduces the effect of manufacturing tolerances on transmission error.
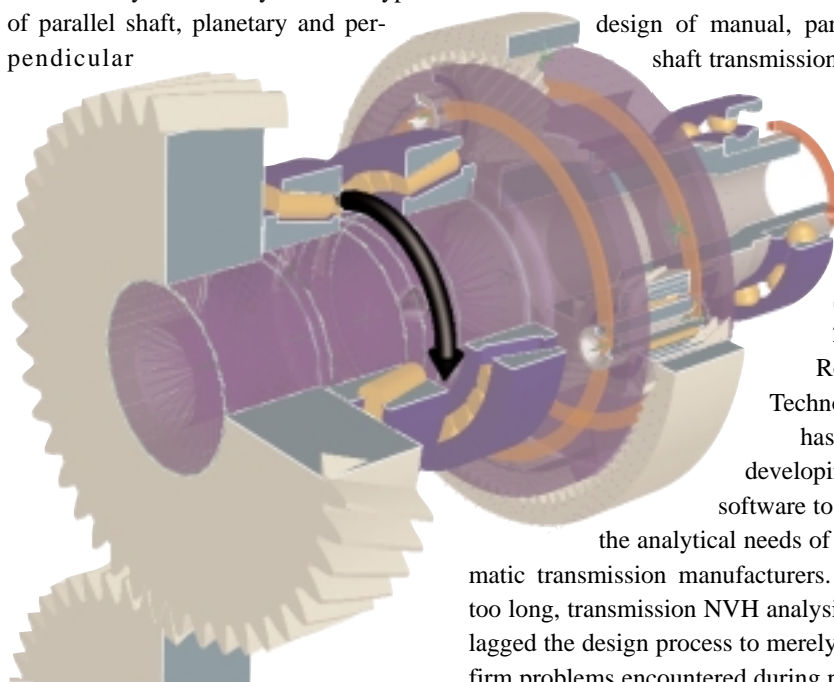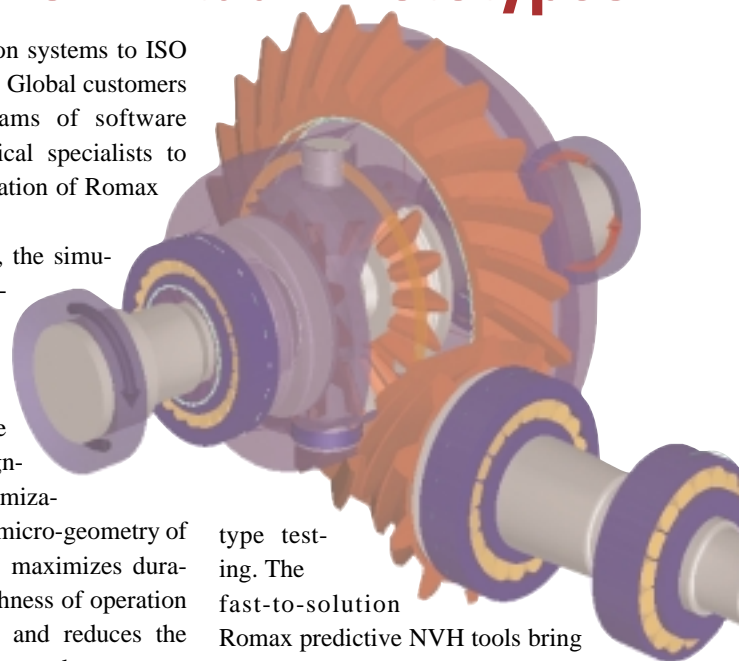
The software is used in the automotive and construction industries for the design of manual, parallel-shaft transmissions.

Since 2001, Romax Technology has been developing its software to meet the analytical needs of automatic transmission manufacturers. "For too long, transmission NVH analysis has lagged the design process to merely confirm problems encountered during prototype testing. The fast-to-solution Romax predictive NVH tools bring design and analysis into phase, allowing analytical engineers to have an influence on the design before hardware is made," says Simon Roberts, business development manager for the North American market. "The extension of the NVH analysis to improve the torque density and reduce gear whine in planetary transmissions has opened a whole new market for us."

The Romax Approach

Traditional finite element (FE) models of transmissions require the combination of measured test results with analytical techniques to understand system dynamics. The models are large, time consuming to build and modify, and require "fudge factors" to correlate the predicted results with measured data before modifications can be made to improve system NVH characteristics.

RomaxDesigner analysis models include the lateral, axial and torsional degrees of freedom to accurately predict

the dynamic behavior of the internal components at the design stage without the need for measured data, Roberts says. The dynamic characteristics can then be used to identify any potential gear whine problems. Modifications to the gear microgeometry and component dynamic characteristics, to minimize transmission error excitation and reduce system responses, can be implemented to optimize transmission NVH levels far in advance of hardware manufacture and test.

The development of such complex virtual simulation software requires close interaction between software developers and experienced transmission design and analysis engineers, Roberts says. In addition to developing the software, this in-house engineering capability also allows Romax to offer comprehensive consultancy services from "find and fix" projects eliminating durability and NVH issues to full turnkey transmission design projects.

"As a company, Romax Technology is committed to enabling transmission design and manufacturing companies to achieve 'right first time' designs," says Poon, "eliminating the risk of encountering problems during development testing, reducing the need for verification testing, shortening the time to market, and minimizing the piece cost of the final product."

For more information:
Simon Roberts,
Business Development Manager
Romax Technology
Rutherford House
Nottingham Technology Park
Nottingham NG7 2PZ
England
Phone: (44) 115-951-8800
E-mail: simonr@romaxtech.com
Internet: www.romaxtech.com

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