Streamlining Drivetrain Design

A new engineering tool accelerates early-stage gearbox modeling and optimization

Cengiz Yilmaz, Product Manager, KISSsoft

Figure 1—Working with sketcher, user interface and 3D geometry on separate screens.

KISSsoft System Module allows intuitive concept design on a system level. In addition to the elementary components, complete gearboxes can now be designed in a separate module. The focus lies on fast concept building and fast calculations of complex kinematics. This is of benefit particularly in the initial phase of a project, when an engineer needs to be able to roughly model different variants of possible solutions to compare critical criteria.

The *KISSsoft System Module* is a versatile tool used in various scenarios, including:

- Designing new products based on key requirements.
- Modifying legacy systems for new conditions.
- Re-engineering reference designs.
- Analyzing existing designs documented through drawings.
- Managing and comparing design variants with the same topology.
- Creating databases of gearbox series with different ratios for different torque ranges.
- Visualizing, explaining, and promoting concepts, proposals, and preliminary designs.
- Elaborating on concepts for costs, mass, and size to enable quotations.
- Connecting, managing, and safeguarding *KISSsoft* files used for modeling individual components.

Working Modes

With *KISSsoft*, the user can choose between the three working modes: Component Level Only, System Level and Collaborative Approach.

The Component Level Only mode involves using *KISSsoft* modules other than the *System Module*. It's a detailed, low-cost, and time-saving approach suitable for less complex systems where calculations for individual components are done independently from each other. This mode is ideal for projects requiring maximum speed, efficiency, and simplicity.

The System Level mode integrates components into a holistic system, combining power flow analysis, spatial and collision-free arrangement, and

top-level requirements-driven conceptual design. It is highly efficient for experienced designers with a deep understanding of all aspects of gearbox or transmission design. It is the mode of choice for most licensees globally.

Finally, there is the Collaborative Approach mode, which supports a team-based design process. Domain experts work on individual components using independent *KISSsoft* instances, performing detailed sizing, optimization, and analysis. Iterative design improvements are uploaded into the system model, gradually enhancing its fidelity.

Switching between these modes is seamless, with data exchange enabled through *KISSsoft* files as well as bespoke and neutral formats (e.g., *Gleason GAMA, GEMS, GDE, REXS*).

Target Users

Target users are, on the one hand, gear and bearing experts, and on the other hand, system architects. The module is suitable for gear and bearing experts because it provides an environment for managing all single components within their expertise. Components are sized, optimized, and rated in familiar *KISSsoft* modules, and once optimized, they can be integrated back into the system model with a single click. System architects, however, focus on ratios, design space, power flow, system reliability, operating conditions, and comparing design variants. They need a clear, communicable design description for stakeholders and are concerned with team-wide access to consistent product data, managing design iterations, and ensuring design survivability under different load regimes.

The software's user interface is tailored to the needs of both experts and system architects, allowing each to view the work in their preferred way without imposing an unfamiliar perspective.

Learning Curve and Required Skills

Familiarity with *KISSsoft* modules significantly reduces the learning curve. The user interface and sketcher are intuitive, leveraging common mouse and keyboard operations. New users can grasp the basics within a day and model complex systems within a week. Users

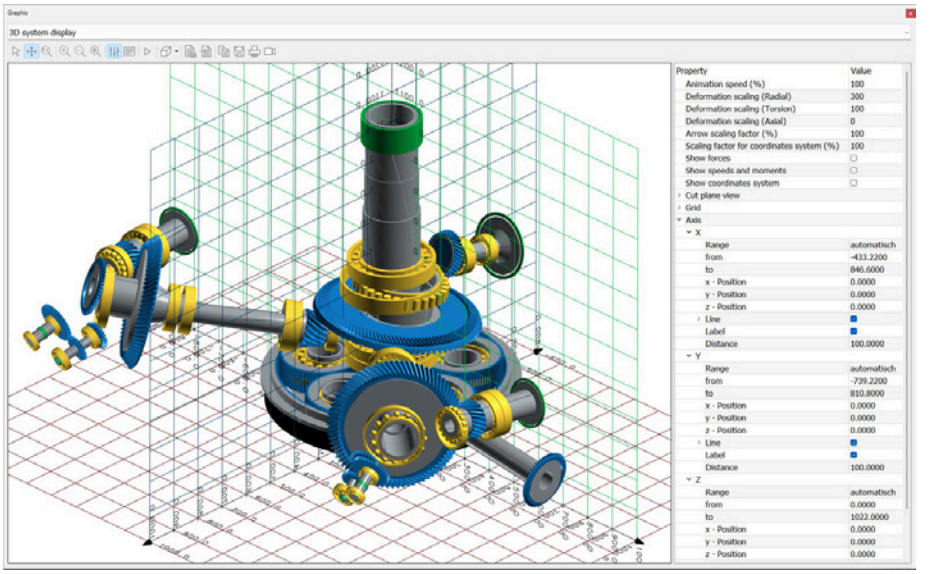
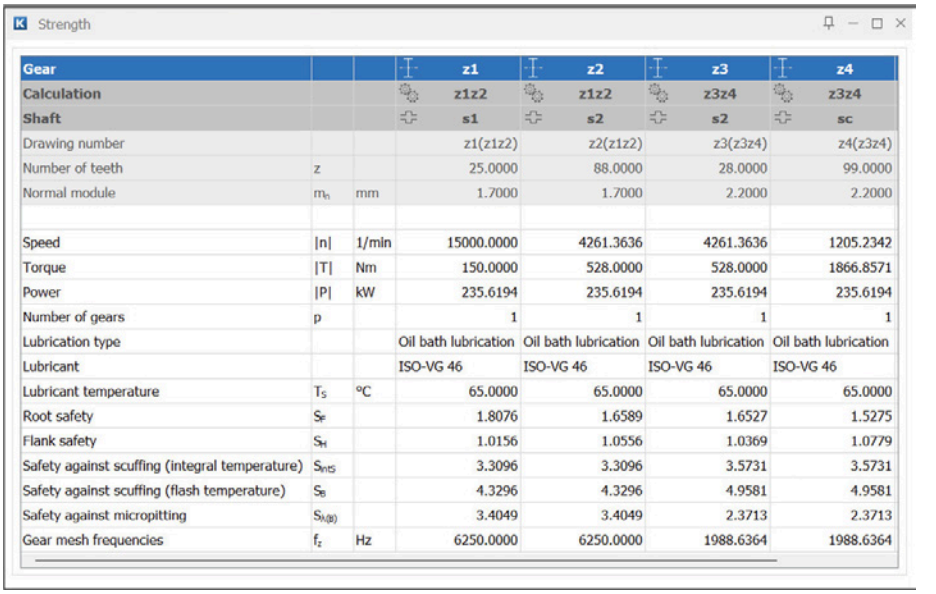


Figure 2—3D view of a gearbox with information about size and scaled deformation.



Gear			z1	z2	z3	z4
Calculation			z1z2	z1z2	z3z4	z3z4
Shaft			s1	s2	s2	sc
Drawing number			z1(z1z2)	z2(z1z2)	z3(z3z4)	z4(z3z4)
Number of teeth	z		25.0000	88.0000	28.0000	99.0000
Normal module	m_n	mm	1.7000	1.7000	2.2000	2.2000
Speed	|n|	1/min	15000.0000	4261.3636	4261.3636	1205.2342
Torque	|T|	Nm	150.0000	528.0000	528.0000	1866.8571
Power	|P|	kW	235.6194	235.6194	235.6194	235.6194
Number of gears	p		1	1	1	1
Lubrication type			Oil bath lubrication	Oil bath lubrication	Oil bath lubrication	Oil bath lubrication
Lubricant			ISO-VG 46	ISO-VG 46	ISO-VG 46	ISO-VG 46
Lubricant temperature	T_S	°C	65.0000	65.0000	65.0000	65.0000
Root safety	S_F		1.8076	1.6589	1.6527	1.5275
Flank safety	S_H		1.0156	1.0556	1.0369	1.0779
Safety against scuffing (integral temperature)	S_{int5}		3.3096	3.3096	3.5731	3.5731
Safety against scuffing (flash temperature)	S_B		4.3296	4.3296	4.9581	4.9581
Safety against micropitting	$S_{H(B)}$		3.4049	3.4049	2.3713	2.3713
Gear mesh frequencies	f_z	Hz	6250.0000	6250.0000	1988.6364	1988.6364

Figure 3—Information about strength rating of all gears in the system in an overview table.

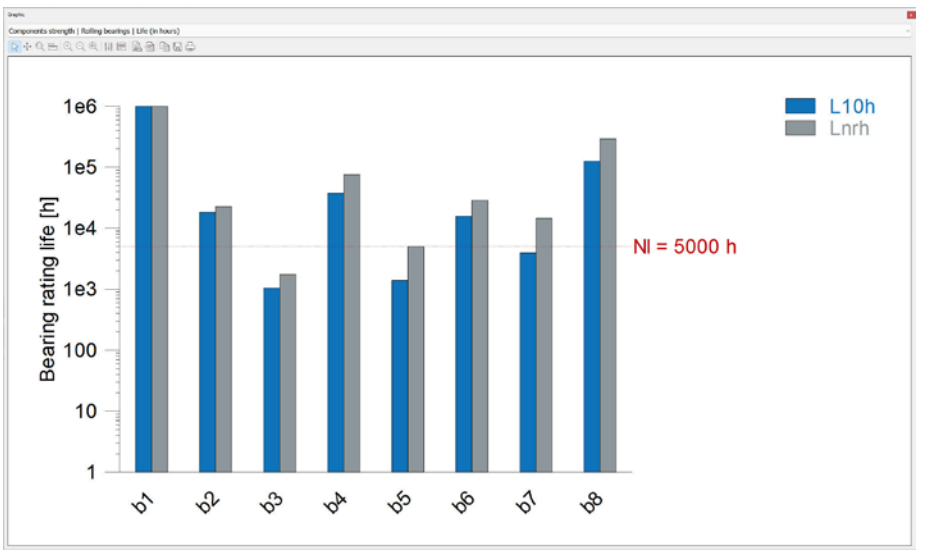


Figure 4—Comparison of bearing lifetimes of all bearings in the system.

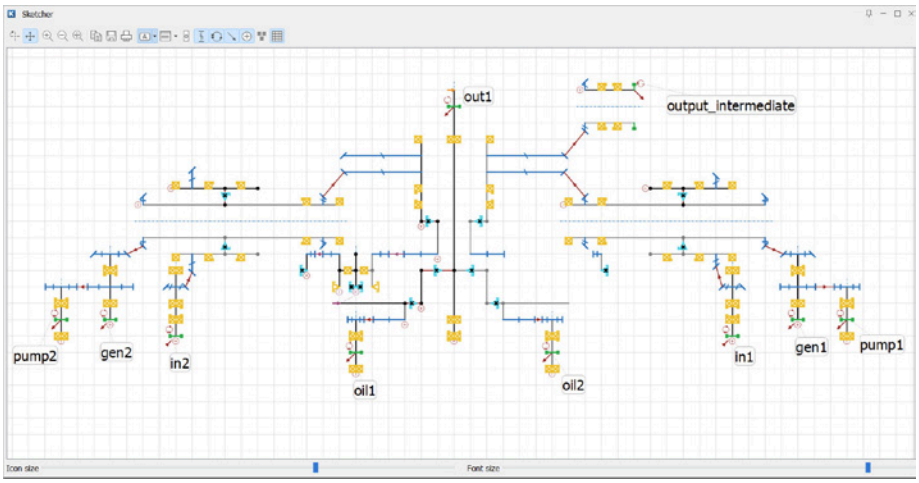


Figure 5—Sketcher window of a helicopter gearbox with multiple boundary conditions: A schematic view of all mechanical components. Power flow in the system is marked with red arrows.

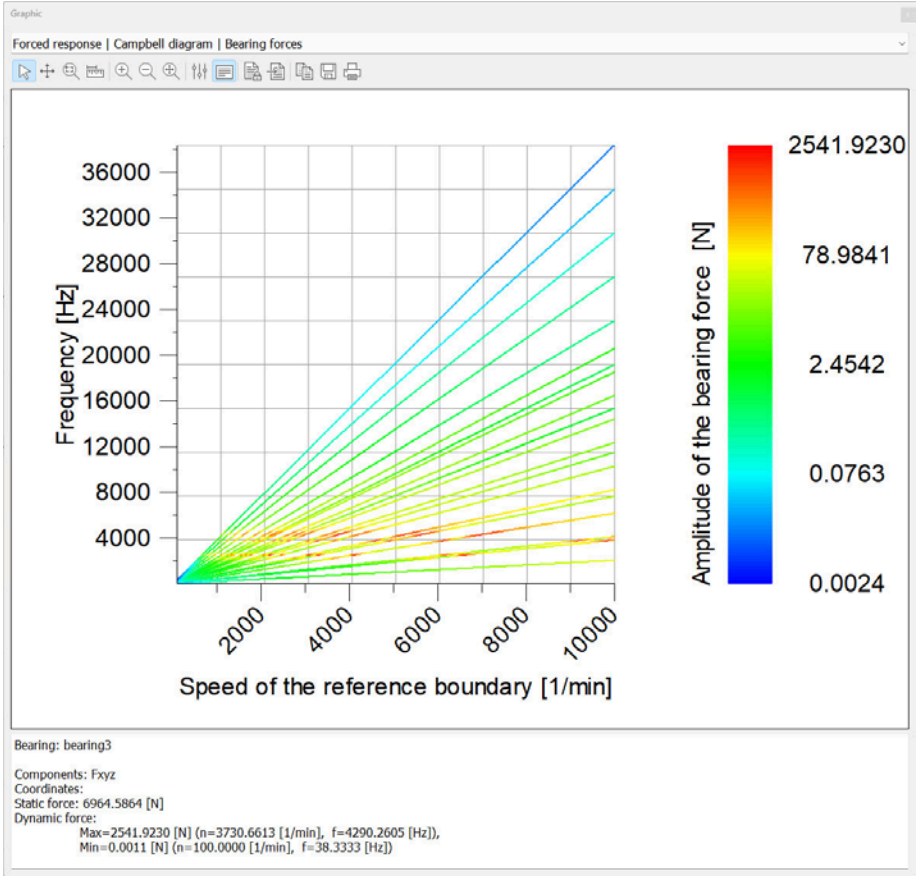


Figure 6—Result of forced response calculation: Campbell diagram of bearing forces and their amplitudes over a defined speed range.

need to master transmission design complexities, including load cases such as spatial and performance conditions. Experience with tree structures, context menus, tables, tabs, multiple windows, and standard engineering terminology is essential. The highly specific terminology used in *KISSsoft* is typically based on ISO, DIN, and AGMA standards. Familiarity with these standards is essential to correctly understand the intention, purpose and limitations of menu options, fields and buttons. To choose settings sensibly, assume derating factors properly, select calculation methods appropriately and use reasonable ranges for e.g., lubrication temperature, tolerance values or required lifetime, the user must have a thorough understanding of e.g., gear theory and methodology implemented in *KISSsoft*.

In summary, the skills and knowledge needed to make the most of the *System Module* are engineering domain-specific, not software-specific.

Return on Investment

The *System Module* supports parameter-based modeling that simplifies the management of complex gearbox and bearing design data. By reducing the need for manual data transfer between components, it helps minimize input errors and supports consistency across design iterations.

In practice, engineers have reported shorter project timelines and greater confidence in early-stage concept validation. Even in basic applications, the system-level approach allows for faster variant comparison and refinement, particularly once users are familiar with the interface and workflows.

As proficiency with the module increases, many engineers adopt it as their preferred environment for both preliminary layouts and detailed system integration tasks.