





ISEO adopts Cetol ${\rm 6}\sigma$ for a global approach to dimensional management

Technical collaboration and support from EnginSoft key to achieving maximum benefit from the solution

By Matteo Calzaferri

ISEO ULTIMATE ACCESS TECHNOLOGIES

ISEO ULTIMATE ACCESS TECHNOLOGIES is Europe's leading Italian multinational company in mechanical and connected solutions for intelligent access control. The company produces products that cover the full range of market demand for access technologies: from residential buildings to large commercial and financial sites, hospitality and transport facilities and critical infrastructure.

Over the past two years, ISEO has been working with EnginSoft to introduce a new approach to calculating tolerance chains when designing a new product. "Working with EnginSoft is of paramount importance for increasing the technical level of ISEO's R&D team, with active and dynamic support guaranteed whenever necessary – and not only during the theoretical training period," states Matteo Calzaferri, Mechanical Design Engineer at ISEO.

The challenge

ISEO has stringent requirements with regard to tolerance management in the development of its products. Calzaferri explains, "Our main requirement is to be able to design locks and cylinders using tools that enable us to conduct tolerance chain analyses of at least five or more components. The calculation and management of tolerances is crucial for us during the design phase because it can have significant effects on production reliability and repeatability."

A further requirement is the need for a tool that enables potentially outof-specification components and their impact to be assessed quickly and accurately so that operators can quickly decide whether to reject a batch of components with certain unsuitable specifications.

Traditional methods limited production performance

ISEO's R&D department required tools that would allow it to perform the overall analysis of the product assemblies and sub-assemblies that the company develops. Prior to the decision to introduce



Cetol 6σ , the company's R&D department used a traditional numerical spreadsheet for the analysis of tolerance chains, which required the dimensions and dimensional tolerances to be inserted manually.

Calzaferri comments, "This method has major limitations, especially when it is necessary to analyse complex assemblies consisting of several components in which both the dimensional and geometric tolerances of the components themselves must be considered. As the number of parts constituting the assembly increases, the tolerance chain becomes more complicated. It is almost impossible to manually calculate these chains in a way that considers all the elements involved." He continues, "The traditional method also doesn't enable engineers to identify which elements have the greatest impact on the tolerance chains and therefore they are not in a position to determine how and where to intervene."

Another aspect that affected the choice for the R&D department was the tendency to perform these calculations from a "worst case scenario" perspective, aiming to achieve greater quality and security, with the result that they always risked specifying tighter tolerances on the drawings than necessary.

Cetol 6σ is comprehensive 3-D model-based tolerance analysis solution that works directly with the CAD definition to help companies build better products through mechanical variation management. It provides product development teams with the insight required to confidently release designs to manufacturing. Precise calculation of surface sensitivities exposes the critical-to-quality dimensions in the assembly. Utilizing advanced mathematical solutions, Cetol 6σ accelerates tolerance optimization to achieve robust designs ready for manufacturing.

Cetol $\textbf{6}\sigma$ and a global approach to dimensional management

Early in 2022, ISEO's R&D team attended a course hosted by EnginSoft on Dimensional Management, Geometrical Product Specification (ISO-GPS) and tolerance analysis. "Shortly afterwards, ISEO decided to introduce the Cetol 6σ software into our R&D process, and the functional approach to mechanical variation management revolutionized our product development methodology," states Calzaferri. He says that EnginSoft played a key role in the development of the software and its use within ISEO: "In addition to the initial course, EnginSoft also provides ongoing technical and theoretical assistance to all the designers in our R&D team, enabling them to increase their skills by applying them to practical cases during product development at ISEO."

The direct interface between ISEO's CAD software and the Cetol 6σ software allows designers to perform an advanced tolerance chain analysis on the entire model that is under development during the detailed product modelling phase. Calzaferri explains, "The introduction of the new software had quite a heavy, transversal impact that initially involved all the designers in the R&D team, and then also affected the departments of industrialization, production and quality control. This gave rise to the need for the development of a global dimensional management approach, which is still ongoing, and which is enabling the relevant ISEO users to acquire important skills in product development, production, and control."

EnginSoft has been supporting this internal development process. "Meetings involving several corporate entities are often held where technical drawings are analysed, and design, process, and dimensional control are discussed to find the best product configurations," says Calzaferri, "EnginSoft plays a key role in these meetings by providing the theoretical support needed to understand the designer's requirements and convert them into clear, understandable instructions for the production and quality control teams."

ISEO's global dimensional management approach starts from the product concept phase and includes design development and prototyping that are addressed through the creation of interdisciplinary working groups; it then covers all other phases of production through to the finished product.

While the implementation of this new approach is still in its infancy in the company, the first results have already been seen in R&D where the use



Fig. 1. Tolerance chain to assess the variation of Clearance in ensuring the assemblage of the sub-system in the cylinder.



of Cetol 6σ has reduced the time required to analyse tolerance chains and guaranteed full control of the internal 3D model. By aligning the full product development process with the ISO-GPS approach, the company expects to reduce flow time (design, manufacturing, and dimensional control) and scrap.

Tolerancing analysis of ISEO's flagship F9000 mechatronic cylinder

One of the very first studies that ISEO conducted with the Cetol 6σ software concerned the company's F9000 mechatronic cylinder, a classic mechanical encryption cylinder combined with an advanced electronic access control system in which energy is transmitted between the key and cylinder inductively without any type of electrical contact. The F9000 mechatronic cylinder is one of ISEO's flagship products and is already available on the market.

ISEO's R&D team used Cetol 6σ to study the sub-assembly of the electronic module with the aim of optimizing the geometry of an existing component in order to improve the coupling between the housing and the actuator, and to reduce waste production during sub-assembly. Cetol

About ISEO ULTIMATE ACCESS TECHNOLOGIES

ISEO ULTIMATE ACCESS TECHNOLOGIES is Europe's leading Italian multinational company in mechanical and connected solutions for intelligent access control. Located in Pisogne (Brescia), it has been working for over 50 years to evolve the concept of security, developing the concept of "UNLOCK YOUR FREEDOM TO MOVE" which brings the value of security into a new dimension: the freedom to move, ensured by the most advanced access technologies. Embodying the "Made in Italy" label, with approximately 1,200 employees worldwide, the brand operates through four production sites and 14 companies, and distributes products in Europe, Asia, the Middle East, South Africa, and South America that cover the full range of market demand: from residential buildings to large commercial and financial sites, hospitality and transport facilities and critical infrastructure.

About Cetol 6σ

Cetol 6σ enables designers and engineers to easily address multi-dimensional problems, using their native CAD geometry. This unique method provides immediate analytical feedback via the easy-to-use modelling, analysis, and reporting components. The user is guided through the tolerance analysis and optimization process whilst being informed about missing or erroneous data. Unlike simple 1D stack-up analysis or Monte Carlo simulation, Cetol 6σ pursues a statistical approach employing advanced and precise constraint technology which is displayed in an intuitive graphical user interface. This approach accelerates the ability to identify and illustrate dimensional sensitivities and the tolerances that have the most significant contribution to the component's variation.

 6σ allowed the sub-assembly of the initial product, which was already in production, and which consisted of nine different components to be analysed in detail. The analysis highlighted the critical points and the dimensions and tolerances with the greatest impact on the positioning of the motor in relation to the housing.

The analysis results enabled the company to accelerate the development of a new geometry to minimize the impact on the coupling of the housing and motor of the components' geometric variations. Cetol 6σ was then used again to analyse the new design in detail, which allowed the designer to produce drawings in which the tolerances and dimensions with the most significant impact were tightened. The company has found model analysis with Cetol 6σ easy to implement because the study is set up directly in the GUI of ISEO's CAD software by applying the contact constraints and tolerances. Calzaferri states, "Here again, EnginSoft's support was crucial because, in uncertain situations, it allowed us to find the correct Cetol 6σ model configuration that reflected the reality of the assembly."

He continues, "Compared to the traditional use of spreadsheets, it has reduced the time to build the model and increased the number of simultaneous variables in our analyses. We were able to analyse the assembly as a whole, something we had never been able to do with spreadsheets due to the complexity of the model and the large number of variables that were impossible to handle simultaneously with a manual calculation method."

Calzaferri states that EnginSoft's support is fundamental, both because his company is new to using the software and because the Dimensional management and ISO-GPS topics are very broad and complex and EnginSoft's theoretical experience is key in being able to apply the method correctly and use the Cetol 6σ software in the best possible way. "We interface with EnginSoft's technicians who are always available to make technical support calls in a manner consistent with our development needs," says Calzaferri, adding: "In the past, due to the complexity of this product, we repeatedly performed two or three rounds of prototyping before correctly defining the geometric configuration. With the introduction of Cetol 6σ we have reduced the prototyping rounds to one, and the newly defined geometry was correct first time and immediately validated."

According to Calzaferri, the goal for the near future is to extend the use of Cetol 6σ to all the designers in ISEO's R&D team in order to reduce development times and costs, and guarantee greater reliability of the products produced. He concludes, "The work of disseminating the Dimensional management and ISO-GPS methods outside R&D will also continue, and will increasingly involve in-house production of the components, the semi-finished and finished products, quality control, and external suppliers."

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