Case Study: **Thales Angenieux**

Adams View helps to optimize time to inspect sub-assemblies for zoom lenses

Overview

The defining characteristic of a zoom lens is that its focal length can be varied. The focal length determines the angle of view — how much of the scene will be captured — and the magnification —how large individual elements will be. The shorter the focal length, the wider the angle of view and the lower the magnification. The advantage of zoom lenses over lenses with a fixed focal length is that you don't have to change lenses to achieve a tighter or a wider composition. Most zoom lenses, particularly those designed for consumer and professional photographers, lose focus when the focal length is changed. But high-end zoom lenses, especially those designed for producing films or television, can be zoomed in and out without losing focus. This type of lens is called a parfocal lens. The first parfocal lens capable of zooming in an out while maintaining precise focus to a degree acceptable for demanding cinema production was designed and built by Pierre Angénieux in 1956, a feat for which he received an Academy award for technical excellence.

Zoom Lenses 25-250

"The position predicted by Adams simulation was exactly the same as that found by trial and error."

Sliman Ayad, Mechanical Design Engineer, Thales Angenieux

Overview (Continued)

Parfocal zoom lenses are very difficult to design and build. Zoom lenses generally consist of three different groups; two of them are moving together (to change focal length) and the last one independently (to focus) and one stationary group of lenses with each group comprising two of more lens elements.

The focus group of lenses moves forward or backward manually to focus the lens but does not move when the lens is being zoomed. The variator group of lens is the moving group of lenses primarily responsible for changing the focal length of the zoom lens. The compensator group of lenses moves in the same or opposite direction but at a different rate in order to maintain the correct focus when the lens is zoomed. Finally the master group of lenses is a stationary group that relays the optical path to the camera focal plane and corrects aberrations of the other optical groups.

How does a focus sub assembly work?

The focusing sub assembly uses a complex mechanism to move the optical groups accurately while also maintaining the optical alignment of all of the lenses. A series of guiding rod and grooves are used to move the optical group. When the cam rotates, the focusing group moves along the optical axis

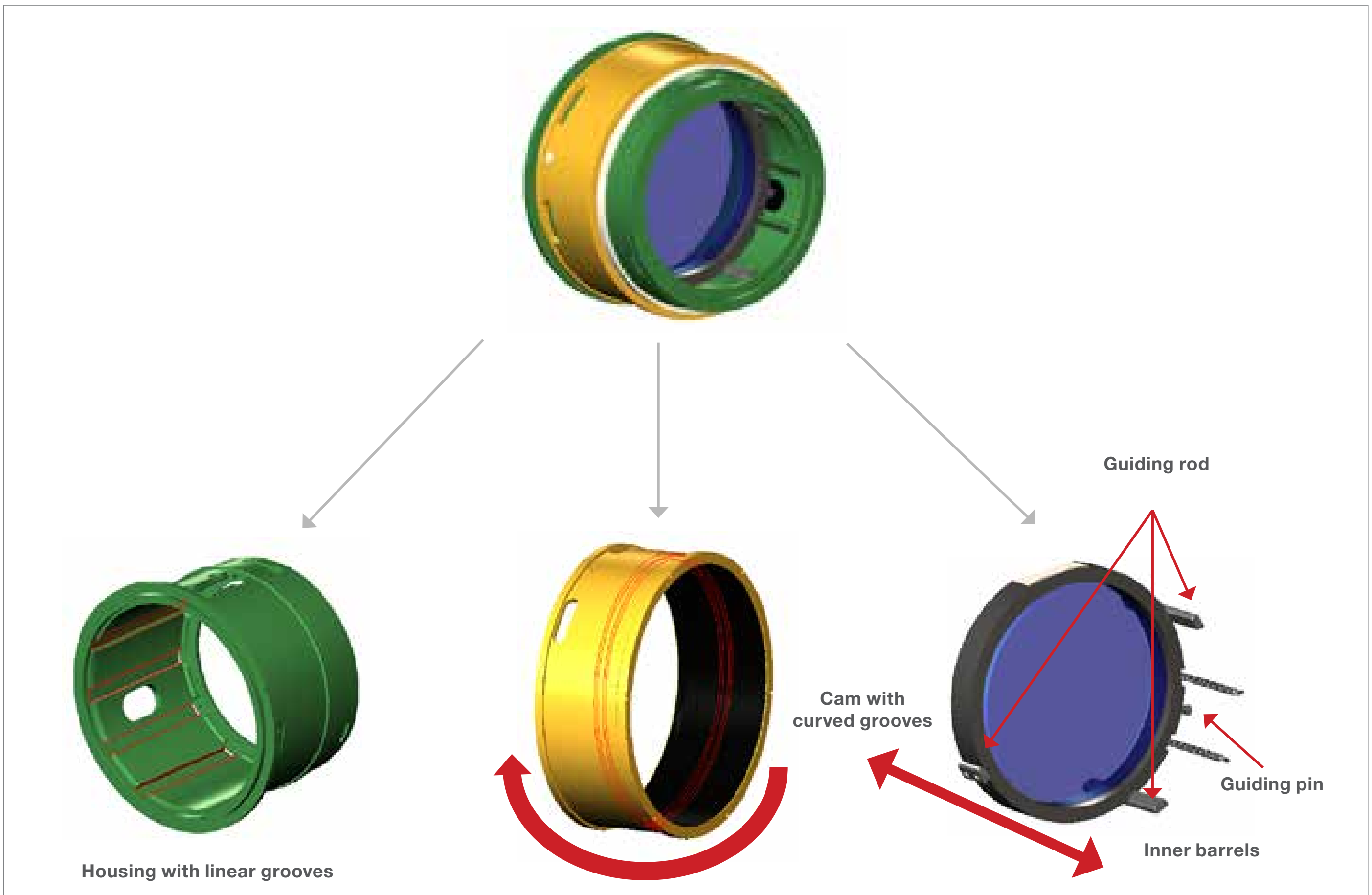
Key Highlights:

Product: Adams

Industry: Manufacturer of precision lenses

Benefits:

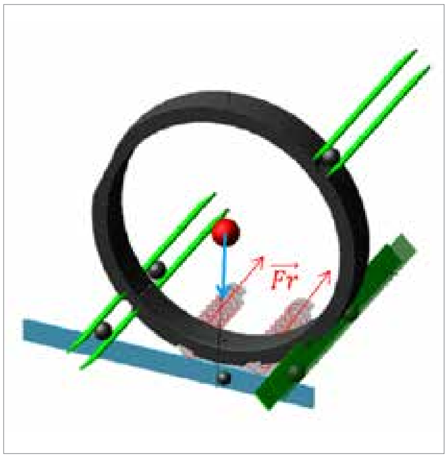
- Inspection time has been reduced
- Less experienced operators can perform the inspection
- Adams simulation accurately predict worst case position



Main components of the focusing group

Challenge

During the assembly of the lens, there are many operations that need to be made to ensure the accuracy of the lens. The most critical is the adjustment of the gap between the guiding rod and the groove. This gap is specified to be within a few microns. When the user moves the cam on the entire course or on a small round trip, the performance of the lens can be damaged depending the stability of the moving parts and the dimension of the gap



Adams model now used to find worst case position

The contact forces between the barrel and housing can change both in magnitude and direction and so affects the displacement of the optical group. In order to adjust the gap, it is necessary to find a worst-case position, i.e the unstable position. "The problem in the past was that Thales inspectors had no way to determine this worst case position so they had to manually perform a series of time-consuming measurements" said Sliman Ayad, Engineering Manager for Thales Angénieux. "The result was that it took a highly experienced operator and many time to inspect a single lens."

Solution

"Two years ago an engineer who had used Adams in another company suggested that we use the software to model our various lenses and determine the worst case position," Ayad said. "To test out this method, I modeled one of our lenses and used the model to predict the worst case position. One of our most experienced inspectors then used trial and error to find the worst case position. The position predicted by Adams simulation was exactly the same as that found by trial and error."

Results/Benefits

With the new method proven, Ayad simulated all of the company's zoom lenses and found the worst-case position for each lens. Now inspectors are able to inspect the tilt simply by moving the lens to this position and making the measurements. The net result is that the time needed to inspect each lens has been reduced.

About Thales Angenieux

Thales Angenieux's origins date back to 1935 when Pierre Angenieux started a company to produce optics for photography and cinema applications. Lenses produced by the company have been used to film many major films and television shows and to record man's first step on the moon. A Thales subsidiary since 1993, Thales Angenieux is still a major producer of television and movie camera lenses as well as the leader in the night vision products and technologies.

For more information on Adams and for additional Case Studies, please visit **www.mscsoftware.com/adams**

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