Consultancy Project

THE BLINKING EYE: right-first-time by virtual testing

The Gateshead Millennium Bridge

One of the newest landmarks in the North East is the Gateshead Millennium Bridge. This striking structure across the River Tyne is the world’s first tilting bridge. The rotation of the structure around bearings fitted at either side of the river has earned it the nickname of the “Blinking Eye”.

That this unique creation worked exactly as planned from the start and was delivered on time is partly down to the close involvement in the project of the Centre for PTMC.

Dynamic modelling and simulation

PTMC specialists worked with Kvaerner Markham, who had overall responsibility for the mechanical, electrical and hydraulic system which controls the entire tilting process, to model the control circuitry and simulate how it would integrate with the 850 tonne bridge structure itself.

A critical concern was the interaction of the structure with the hydraulic actuation systems at each end of the bridge. As the structural design was fixed, the onus was on the PTMC engineers to identify a hydraulic system that would operate correctly under all foreseeable conditions. There was no scope for error as a single malfunction could cause structural damage.

In order to determine the dynamic interaction between the bridge structure and the hydraulic circuits, the structural dynamics from a finite element analysis were incorporated into a hydraulic simulation model, built with the PTMC’s proprietary Bathfp fluid power system software.

Results: reality matches predictions

The modelling work initially showed that interaction between the hydraulic circuits and the bridge structure could lead to excessive bridge oscillation. Re-design and rigorous testing in simulation was used to reduce the risk of this occurring in practice. No major problems were encountered during commissioning and the actual motion of the bridge was the same as that predicted by the model.

The work carried out by the Centre was critical to the success of the project and demonstrates the benefits of performing a detailed simulation at the design stage.