HyperWorks Accelerates Design Process and Development of Diesel Export Locomotive at RDSO

Overview

Altair HyperWorks helped RDSO reduce development time and optimize structural characteristics of the diesel export locomotive. Physical testing on these large, complex structures had to be limited. Using HyperMesh/HyperView pre/post processing capabilities, RDSO were able to simulate design and verify that engineering specifications are being met and help validate the final design.

Business Profile

Railway Testing and Research Centre (RTRC) was setup in 1952 at Lucknow, for testing and conducting applied research for development of railway rolling stock, permanent way etc. Central Standards Office (CSO) and the Railway Testing and Research Centre (RTRC) were integrated into a single unit named Research Designs and Standards Organisation (RDSO) (www.rdso.gov.in) in 1957, under Ministry of Railways at Lucknow.

Challenge

To establish Indian railways as genuine supplier of Diesel locomotive for south Asian and African market, RDSO was under pressure in developing diesel locomotive to meet demands of performance, reliability, fuel economy, crashworthiness and operator comfort. Locomotives must operate economically and safely for decades under harsh conditions with a minimum downtime. Durability of components undergoing repeated fatigue cycles is a major concern. Most units log more than 1 million miles during the first six years of operation and have a useful life of nearly 30 years, with some major components lasting more than 50 years in the used equipment market. Achieving these goals while shortening the development cycle was particularly challenging because of the significant time and cost factors associated with running physical tests on such large, complex machines. Motive Power had been using simulation tools since 1990 but that time for pre processing was too high due to limitations of computing machine and software. RDSO met these challenges with engineering simulation throughout design from the conceptual stages of development. Using HyperMesh simulation as a verification and validation tool, RDSO minimized physical testing while shortening simulation development time and optimizing structural characteristics of the diesel export locomotive.

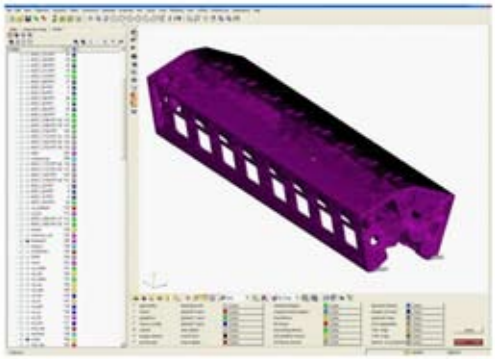

Figure 1 :
16 Cylinder ALCO Engine Meshed Model

"HyperWorks has helped us reduce simulation development times substantially while ensuring we have quality models for analysis and also offers further expansion areas for optimizing, multi-body dynamics and crash simulation."

S.Mani
Executive Director-Motive Power
RDSO

Solution

RDSO uses HyperWorks for structural analysis in evaluating stress, deflection and modal analysis of components. Simulation is also used to guide designers in sculpting the basic shape and topology optimisation of parts early in development. Altair HyperMesh is also used in detailed analysis of suspension dynamics, vibration isolation mounting of the cab and other subsystems, as well as in the validation of design/development and modifications of the crankcase, cylinder heads, piston rods and other reciprocating parts of the locomotive's diesel engine.

Results

Using Altair HyperMesh stress analysis of underframe/platform was performed and helped RDSO to optimize the under frame, also enabling to reduce weight which was penalty on account of increase in length due to induction on RE cab. HyperMesh is now a part of the standard design simulation process as a verification and validation tool. Using HyperWorks RDSO minimized physical testing while shortening development time and optimizing structural characteristics of the diesel export locomotive.

Benefits

Altair HyperMesh enabled RDSO analysts and designers to virtually optimize the design of individual components and assemblies as well as the overall locomotive structure. By studying alternative configurations, the product development team was able to make informed decisions on trade-offs among stiffness, weight and natural frequency requirements. Structural analysis of both the engine and the full locomotive played a key role in increasing fuel efficiency while maintaining high durability and operator comfort with minimized vibrations throughout the structure.

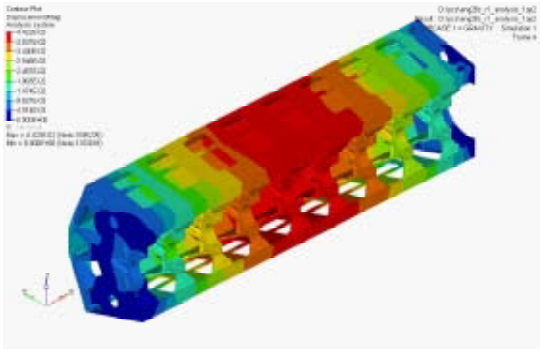

Figure 2

16 Cylinder ALCO Engine Block – Displacement Block

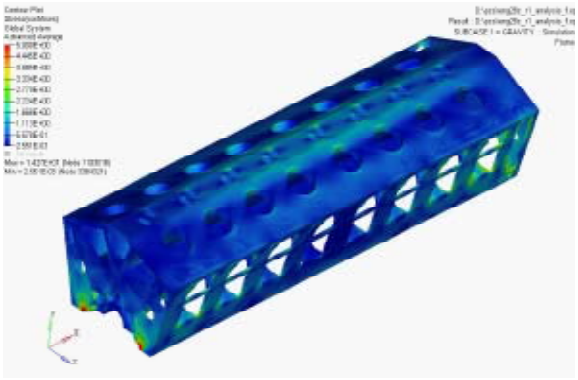

Figure 3

16 Cylinder ALCO Engine Block Stress Plot

Figure 4

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