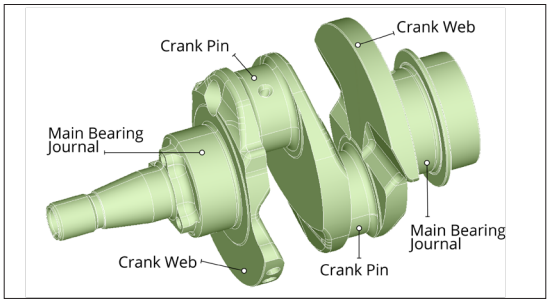
Automating Crankshaft Modeling for BMW Motorrad Using Altair SimLab™

BMW Motorrad is the motorcycle division of BMW, a German multinational company manufacturing luxury automobiles and motorcycles. With the first motorcycle manufactured in 1923, their current product line includes a variety of shaft, chain, and belt-driven models designed for off-road, dual-purpose, and sports powered by a variety of engines ranging from a single cylinder, various two cylinder (parallel twin, flat twin, boxer etc.), four cylinders inline and six-cylinder inline ones.

Crankshaft Model Building



The typical key elements of a crankshaft are the Main Bearing Journal, the Crank Pins, and the Crank Webs

Crankshaft model building for BMW was previously outsourced to external providers with average time taken for a model being between 1-2 weeks depending on the engine type. Established procedures at the organization require an annual estimate of new crankshaft models to be produced, based upon which budgetary decisions can be made. Often, actual production of the number of models would fall short of estimates due to varying constraints on the part of the suppliers. In addition, for any additional crankshaft models when required, overall order processing time could take long. To facilitate effective budgetary planning and decision-making, accuracy in model production forecasts with a high degree of confidence became necessary. Based on a recommendation from an employee having worked with Altair SimLab at another facility, the group at BMW chose Altair as a development partner in order to explore alternate solutions.

Industry
Automotive

Challenge
Lead time reduction in model build process by automating crankshaft modeling for BMW Motorcycle

Altair Solution
Automation of crankshaft modeling process using SimLab

Benefits
- Reduction of 80% in model creation time – ½ day vs. two weeks of modeling time
- Enabling accuracy in budgetary forecasting and planning
- Consistency in model quality
- Flexibility in model building as a result of being an inhouse resource
- High efficiency with iterations

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The initial, preferred course of action for the first project was to clone the classical approach. This entailed duplicating a previous vendor's process and building the model without using all the SimLab features. In parallel however, Altair engineers developed the same model using SimLab technology and then demonstrated the process to BMW. As motorcycle crankshaft simulation uses a detailed FE-mesh for structural and fatigue analysis, due to long time durations for FE meshing, the idea was to establish a process for automated crankshaft meshing in SimLab. With the second project, the classical process was migrated to a complete SimLab process. The semi-automated process applied by BMW Motorrad to model an engine crankshaft for structural and fatigue analysis using SimLab includes the following steps:

- Group assignment
- Mesh controls & surface mesh
- Layered elements, volume mesh & RBEs
- Renumbering and group set definition

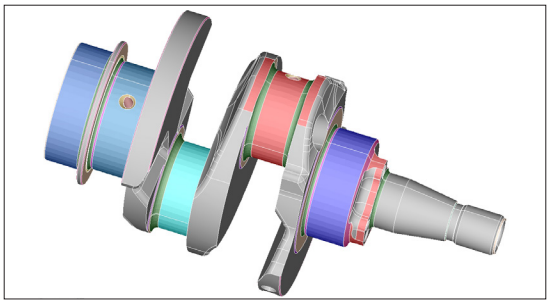
The comparison tools inside SimLab identify the difference between the current model and a new variant, and help to transfer the group structure from the current model to the new variant with very little user interaction to update the groups. The group structure is the basis of the overall automated process.

Using the SimLab process has reduced model creation time for BMW by about 80%. For the 4-cyclinder, the user interaction process that previously took about an hour, has now reduced to 5-10 minutes using SimLab. Time to build a first new model has been reduced to about half a day and for consecutive variations to about an hour.

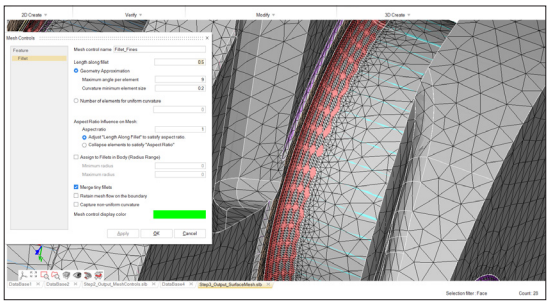
"The traditional FE modeling process was migrated to a complete Altair SimLab process, which reduced model creation time for BMW by about 80%. With this signification lead-time reduction, the primary benefit as a result has been to enable better budgetary forecasting and decision-making, record improvements in the production process and a great degree of flexibility. "

New Models, Budgets and Increased Flexibility

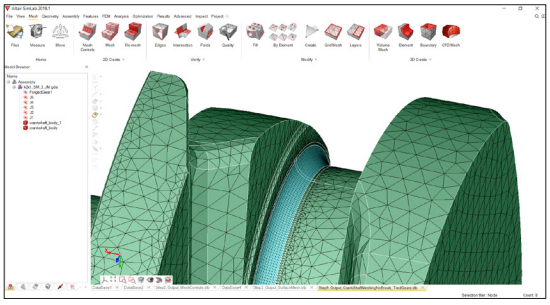
With this significant lead time reduction, the primary benefit as a result, has been to enable better budgetary forecasting and decision-making, record improvements in the production process and a great degree of flexibility. With model building now insourced, they can be built as and when required, without dependence upon external vendors.



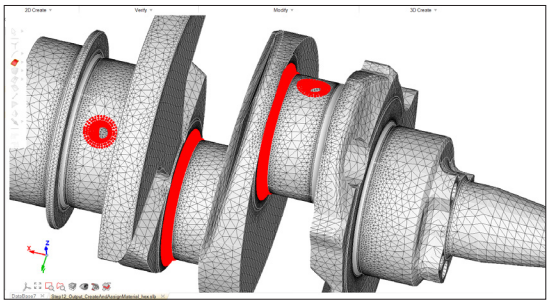
After importing and positioning of the CAE file, the process begins with the group assignment



A surface mesh is created in step 2 using the respective mesh controls



One of the most intensive steps of the process, step 3 involves several tasks such as layered element volume generation and gears meshing



Carried out in less than a minute, step 4 mainly consists of the generation of elements proofs and nodes sets

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