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FEMFAT software
BY MAGNA POWERTRAIN

Partner Spotlight: ECS/Magna - FEMFAT

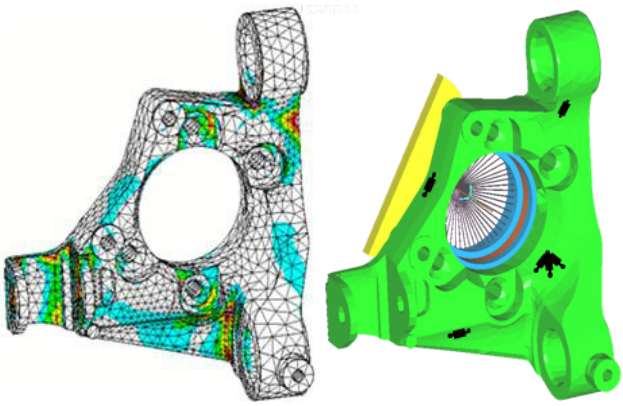
Axel Werkhausen, Manager of Sales & Support at ECS, discusses durability analysis software, FEMFAT, available through the Altair Partner Alliance.

APA: What prompted the development of your software? What problem(s) is FEMFAT meant to solve?

Axel: Finite Element (FE) analysis has been performed in Steyr Daimler Puch since very long time ago – the first projects and reports were manually colored by the engineer because a color printer was too expensive. At that time in the early 1980s, the stress result was not sufficient to talk about the life of dynamically loaded components or a survival probability, so inhouse methods and, shortly after that, a software code was developed and used for customer projects. As customers asked about that procedure and requested more and more information, the software was taken to the first level of approval, ensuring that even an untrained engineer could run it: documentation, training material, licensing, etc. were all decided upon.

The whole process was very new, but it worked for all the big automotive OEMs ibecause the solution was very close to test results, and at that time even testing was more expensive than analysis power. Developing a software in front of the customer directly creates tasks and requests from the customers, so our development team had a chance to collect such requests and compare them with the ideas we had ourselves in order to find solutions and methods to implement to the software.

APA: What are the benefits of using FEMFAT for durability analysis?



Axel: FEMFAT is a strategic open engineering database. If the engineer has some familiarity with FEA – meaning they have a good understanding of the mechanics, a feeling for realistic behavior of a component, like what cause higher stresses or higher deformations and stiffness, they may start looking for more information, such as the fatigue life. However, just putting the data into a black box and watching colourful plots is not what they are looking for - they are more interested in the specifics of what happens. Where are the original 230 MPa from the stress plot? Then they discover that there is a dynamic amplitude stress and a constant stress that sum up to these 230MPa in that loadcycle. It was rainflow counted, so the same cycle could be found another 1200 times in the signal and that's why the aluminum component in this particular FE-node can only survive 500 such load histories as imported. That's what the engineers like to see! They don't want to be fed by results, they want to understand it and to follow up, to learn how the result can be achieved.

APA: How much time does it take to learn and start using FEMFAT?

Axel: This is very strongly related to the experience of the engineer – not the experience with FEMFAT, but with mechanical engineering and the logic behind our GUI and method.

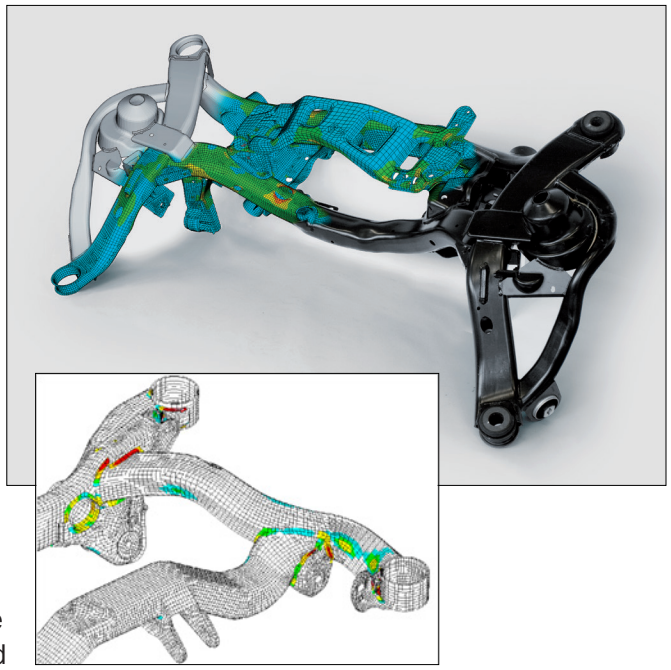
If we train an FE analyst on FEMFAT, they are ready for the theories and some first practice examples within about two days. If the engineer is able to study the training material on their own components during the evaluation license period (2 months) for at least one hour a day, then they are able to perform fatigue analysis without further help.

Personally, I was surprised that a professor at university was able to teach FEMFAT after only intensive study and without our training, but with some help from our support, within the 3 months of vacation between semesters.

APA: What's next for FEMFAT ... what can we look forward to?

Axel: As our longterm customers have noticed, in the past 3 years we have come out with a module to access vibrational fatigue from stochastic and deterministic loadings, a methodology to access short fiber reinforced plastics, a module for endless fiber laminated structures, an add-on tool for rubber fatigue analysis and improved interfaces. So the new materials and their analysis procedures are our main focus. We still have to improve the capability and engineering understanding in the fatigue behavior of these fabricated fibers. The new developments are therefore related to the latest modules and materials side by side with improvements to existing modules WELD and SPOT.

APA: What are the biggest challenges or problems that customers in your target market face and how do you address their needs?



Axel: I think the question already got answered in points 2 and 4 – the engineer is asked to do fatigue life prediction on components without complete information. Either the fatigue behavior and strength value of the material are not correlated or known, or the loading and boundary conditions are not yet possible to measure (because it is a new part and the structure around the area is also under development). As you know, in order to solve an equation, it is necessary to know as many independent equations as variables (uncertainties). That's where good parameter studies help to justify step by step all unknowns.

APA: Describe a typical workflow using FEMFAT.

Axel: The workflow is like the menu in our GUI: starting with the FE-model to import into FEMFAT, proceed to enter the stresses and loading in the material data needed and advice all the groups of FE-nodes of their best known characteristics (material, surface treatments, temperatures,...). The rest of the setup is related to the analysis aim and which output is desired for the report.

The process gets more complex if it is necessary to use more information form manufacturing processes – the positive point is that there are many ways for fine tuning and therefore many ways to get complex results. If a stress amplitude is the only thing imported and there is a standard material used, the S/Ncurve shows the fatigue life nearly as simple as by hand calculation. For more complex input the problem gets multidimensional and the engineer has to understand much more than just a double logarithmic line with a change in inclination.

Maybe to understand the workflow very easy, it is a good idea for the reader to click through the interactively designed "Getting Started" Tutorials on our website www.femfat.com >Downloads > Getting Started > FEMFAT. It is worth noting that this download area is protected by a login. Some of the webinar recordings available on the APA website may be helpful as well.

APA: Is there a use case or case study that highlights your software's strengths?

Axel: We are very proud of the big variety of FEMFAT users and the ability to motivate 5 to 15 engineers every year in several regions to share their experience in fatigue analysis with FEMFAT in our usermeetings. This year, the 10th International User Meeting in Steyr has taken place and also the second in Pune/India and the sixth in Korea; next year China, Japan and United States are hosting user meetings as well. From each presentation we publish the available slides on our website: www.femfat.com. Therefore, case studies are really everywhere - FEMFAT is benchmarked by 99% of our customers before they make a decision to buy the software and get an engineer trained for becoming a fatigue specialist. The other 1% of our customers were driven by OEM authorities to buy the software for project work with predefined scripts – They start working with FEMFAT because the OEM did the benchmark successfully.

For more information about FEMFAT through the APA, visit the solution page.