NAFEMS UK Regional Conference 2018 - Abstract Submission

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Please identify the event for which your submitting?	NAFEMS UK Conference 2018
Will you be the presenting author?	Yes
Presentation Title	Applications and Limitations of Structural Optimisation
Relevant Themes / Keywords	Optimisation, Durability, fatigue

Abstract (plain text)	The industry norm seems to be heading down the approach of utilizing topology optimisation for its structural components. This typically looks to optimise for maximum stiffness. Looking at a few case studies we look into what are the limitations of this and how to get the most out of these results. We start off by finding the optimal material distribution/rib structure but then move onto parametric studies to find the optimal dimensions of that structure. Typically the main focus of this is to reduce stress or fatigue. Here we also look into system level analysis in order to work out how components interact with each other. This leads us to condier more than just the single component in isolation. We can then influence the system rather than individual components. Through these case studies we see this as a huge need in industry right now and where we see the advances in these tools going. Design of a crosshead in a valve train is very simple. Due to a design change the loading has significantly increased. we had to design and analyse a new crosshead that maintained the fatigue strength but also maintained the same weight due to the dynamics of the valve train. Here a parametric study is performed to find the optimal design based on a few basic design criteria. Main bearing caps are very well understood today but due to testing requirements a tapping has been added through the cap. This inherently makes the cap weaker. Here we look into the optimal rib structure using topology optimisation and work out the size of the dimensions needed in order to maintain the fatigue strength but also to maintain the weight of the cap utilizing parametric optimisation. Due to new more efficient systems being added to the engine, the support structure needed to be redesigned. The importance of a support structure is not only to be strong enough to take the weight of what it is holding up but also to make sure it is compliant enough so that the joints that it is using are capable of taking that load without failure. Here we look into how topology has been used to find out the optimal material distribution/rib structure and then further used parametric optimisation in order to reduce the stress in the support bracket but also reduce the loading in the joints by maximising compliance to maintain robustness.
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