POSTPROCESSING ANALYSIS RESULTS OF BURST TEST SIMULATIONS FOR AUTOMOTIVE PLASTIC AIR INTAKE MANIFOLDS

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ABSTRACT – Accurate predictions of static burst test simulations of automotive air intake manifolds is a process that requires knowledge of empirical data obtained from a series of part testing. This data is then implemented in the structural simulations using a variety of structural analysis codes. The structural software used in this particular case generates a huge amount of results, depending on the size of the finite element analysis model used. Processing of this data is a very manual and time consuming process to accurately predict not only the location but also the internal pressure that will result to part failure.

The current process requires first the identification of high stress areas. Then the areas of interest are isolated and the analysis results, which are stresses, nodal forces and moments, are manually recorded for each region. The recorded data are then processed outside the postprocessing software, μETA postprocessor in this case, using a proprietary technique developed using empirical data from a large number of experiments to establish appropriate material strength levels at the weld bead regions. This process provides accurate predictions of the static internal pressure at which failure in the vibration welded part will be initiated. Nevertheless, it is a very cumbersome and time consuming process which makes regular use unattractive and it is implemented only in cases where problems are encountered during the validation process.

Using a script developed to execute within the μETA postprocessor the above process is fully automated and can be easily applied for shell as well as solid element meshes. As soon as the non-linear structural analysis is completed the results can be very easily processed using the μETA script. In addition, the limitation of investigating failure at only a few selected locations to reduce the time needed to perform all the calculations is hereby eliminated. Using the μETA postprocessor the calculated "Burst Failure Index" numbers for any area of the weld bead can now be plotted by the software quite easily. This gives the designer a global view of all weld bead regions and thus areas of concerned can be easily identified and modified to further improve burst performance.