L’Ralph’s Advanced Thermal Model Correlation Using Veritrek

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# ABSTRACT

Thermal model correlation uses data from thermal balance tests to better estimate uncertain input parameter values. During the correlation process, input parameters are modified in an iterative manner which can become computationally expensive since this requires that the high-fidelity thermal model be run for each iteration. Depending on the number of thermal balance test points there can be many sets of correlation parameters that satisfy correlation criteria; and having enough data to ascertain the best set of correlation parameters to use, further increases the computational expense. Reduced-order models (ROMs) provide computationally efficient surrogates of high-fidelity models and are often built to reduce development cycle times and cost. By leveraging the speed of reduced-order models and the Correlation Analysis feature in the Veritrek software, the typical computational expense of a traditional thermal model correlation process can be significantly reduced and having access to hundreds of thousands of iteration results provides an advanced means of intelligently determining the best set of correlation parameters to use.

The L’Ralph thermal team at NASA Goddard Space Flight Center explored the use of the Veritrek software for their thermal model correlation efforts. The ROM that was created allowed for the variation of 15 input parameters to match 70 temperature sensor readouts from 3 thermal balance points and required 125 runs of the high-fidelity Thermal Desktop® model to generate a ROM that could predict the detailed model’s results to within 0.2 K (RMS). The ROM was then used to find dozens of plausible correlation parameter values based on L’Ralph instrument test data within a few seconds. By providing several plausible correlation parameter combinations, Veritrek allowed the thermal team to explore different uncertain parameter value combinations and provided insight into how deterministic each input parameter was. This allowed for a more confident decision on the best set of correlation parameters to use, compared to traditional model correlation techniques. In this presentation, the L’Ralph thermal team will be presenting their experience with the Veritrek software and how the software was utilized to provide additional insights during the correlation process.