Hybrid Certification: Merging Physical and Virtual Testing

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ABSTRACT

Simulation continues to get closer to predicting specific physical crash phenomena and is becoming more prevalent in product design; however, “Certification by Analysis” remains elusive for much of the aircraft seating industry. Much as linear FEA approaches began to substantiate static certification a decade or more ago, emerging Explicit/Implicit/Kinematic Nonlinear approaches are beginning to reduce physical testing today.

Dynamic certification (destructive crash testing) targets a minimum level of safety performance. It is primarily a pass/fail standard to prove out design intent and manufacturing quality. It has been prone to repeatability problems and been very expensive compared to NDT and Static certification.

Conversely, Simulation (or analysis) attempts to estimate physical performance. It can guide design to optimal performance within an assumed margin of error, yet has been prone to errors in implementation and inaccurate assumptions.

By mixing reliable and well-understood aspects of both physical test and simulation, hybrid techniques are reducing costs and time. Various case studies are presented to highlight these benefits, including:

- Explicit/Implicit Nonlinear analysis: system models for specific purposes
- Legacy FEA approaches laced with physical input/output
- Efficient Static and Vibration Optimization for subassemblies
- Effective communication & documentation
- Costs saved, reduced time to market, ...

Background on the Author

Tyler Smithson has twenty years of engineering analysis experience. His career started as a FEA software developer and at one time included responsibility for MSC.Nastran software development. He is a licensed Professional Engineer and has had primary design authority on a variety of structural systems ranging from rollercoasters to solar energy systems. His research has included live micro-crack propagation detection in metals and failure/repair optimization in aircraft composites. He is currently managing simulation and stress engineering at Zodiac Seats California, LLC.