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BENCHMARK MEASUREMENTS AND MODEL VALIDATION

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ABSTRACT

Additive manufacturing (AM) is a highly multi-scale and multi-physics process that is being used for demanding applications in aerospace, health care, civilian nuclear, defense, and other applications. Processing conditions, microstructure, and properties typically vary by location for most AM technologies, leading to a critical need for quantitative models that span the entire processing-structures-properties-performance space. The demand for rigorous validation data is unprecedented, and the Additive Manufacturing Benchmark Tests (AM Bench) organization [1], led by the National Institute of Standards and Technology (NIST), provides a continuing series of AM benchmark measurements, challenge problems, and conferences with the primary goal of enabling modelers to test their simulations against rigorous, highly controlled AM benchmark measurement data. These measurements are planned and conducted by researchers from more than a dozen institutions across the United States. SIM AM is the largest European conference dedicated to AM simulation and is a natural partner for AM Bench. This invited session will bring several AM Bench measurement experts to SIM AM to describe a subset of the metals and polymers benchmarks and challenge problems that will be completed by August 2025. Short descriptions of these benchmarks and challenge problems are available online [2]. This session will also include speakers who have used AM Bench measurement data for model validation. In 2022, AM Bench received 138 submissions to its challenge problems so there is no shortage of quality modelers to choose from. Lastly, the AM Bench partners have made significant investments in AM data management. At least one presentation will describe these data activities including descriptions of how modelers can access and work with the AM Bench measurement data. The primary objective of this session is to bring modelers, experimentalists, and data scientists together to explore ways to increase synergy and the impact of our work.

REFERENCES

[1] Levine, L, Lane, B, et al., *Outcomes and Conclusions from the 2022 AM Bench Measurements, Challenge Problems, Modeling Submissions, and Conference,* Integr Mater Manuf Innov, **13**, 598–621 (2024), DOI: https://doi.org/10.1007/s40192-024-00372-4

[2] <https://www.nist.gov/ambench/short-descriptions-2025-benchmarks>