# Efficient strategy for distortion and residual stress prediction in Additive Manufacturing

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## ABSTRACT

In metal additive manufacturing, thermal stresses and resulting part distortion may lead to dimensional quality issues and premature fatigue failure of components. It is thus required to combine numerical tools and modeling approaches to investigate and understand physical phenomena leading to those side effects.

This work presents a methodology, based on finite element models, for the determination of residual stresses and distortions for the Laser Beam Melting (LBM) process. A transient thermo-mechanical analysis combined with element activation technique of macro-layers, i.e. groups of typically tens powder layers, is used. For each macro-layer, an equivalent heat source determined from the process parameters is applied uniformly and deformation and stresses are computed for each heating/cooling cycle.

This strategy was used during the benchmark test challenge 'AM-Bench 2018', organized by NIST [1], in order to predict the residual stresses and distortion of a bridge structure built in nickel based superalloy IN625 by laser powder bed fusion. The calculated residual stress distributions and distortions are compared with the experimental results.

## REFERENCES

[1] AM-Bench website: www.nist.gov/ambench