# Model Reduction Method For The Simulation Of The Selective Laser Melting Process

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**Abstract.** Additive manufacturing allows a personalized manufacturing of low-volume products, with geometric complexities. The most common technology is the SLM (Selective Laser Melting) process. This process consists in progressively deposing metal powder so as to constitute pieces of complex geometry, with a design that makes it possible to reduce the quantity of lost materials.

Numerical simulation is an interesting tool to ensure the control of the process and the quality of the final part. In addition, the numerical simulation reduces the experience phase necessary for the adjustment. Difficulty arises from having a field of computation that evolves over time, so we create the piece as we go along, and we are interested by the physical phenomena that interact during the production of the piece.

First, we are interested only by the thermal aspect: the objective is to be able to reproduce the evolution of the temperature during manufacturing. The repeated cycle induces a high calculation cost. Therefore, instead of using classical FEM whom limitations are known, we will take advantage of alternative calculation method thus become more efficient. Indeed, the model reduction algorithm consists in projecting the initial thermal problem on domains with lower dimension and recursively solving on each one. The first method we applied is the Proper Orthogonal Decomposition (POD). Nevertheless, in order to estimate the solution that the FEM should give; a priori methods are used as the APR method using the snapshot POD, and the Proper Generalized Decomposition (PGD).

In this work, we will present different tools allowing to determine the best approach of the thermal modeling. The calculated thermal history is then compared to the temperatures simulated by a FEM. The results obtained illustrate the ability of the reduced model to faithfully reproduce the macro behavior of the constructed part.