A parametric reduced order model for real time simulation of the thermo-mechanical coupling arising in blast furnaces

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In this contribution, we propose the development of a Reduced Order Model (ROM) for real time simulation of the thermo-mechanical phenomena arising in blast furnaces. The full order model is given by energy and momentum equations in axisymmetric formulation for an isotropic homogeneous material. We use the Proper Orthogonal Decomposition (POD) to construct the reduced basis space. On the other hand, for the computation of degrees of freedom, we use Galerkin projection (Gp) and Artificial Neural Network (ANN). Both physical and geometrical parametrization are considered. Next, we introduce in the full order model, the effects related to the temperature dependence of material properties (non-linearity) as well as presence of different materials (heterogeneity). In particular, homogenization is used to identify an equivalent orthotropic material from the periodic assembly of homogeneous isotropic materials. Finally, we present challenges and perspectives aimed towards extending ROM approach to this more complex modelling framework.