# *Optimization of Steel Production by Artificial Neural Networks*

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**Keywords:** Optimization system, neural networks, steel production

***Abstract :***

Steel production plants are often faced with the need to quickly adjust processing parameters in order to satisfy customers' requirements with respect to material properties and quality of semi-finished products. At the same time, design of production process is restricted with the layout of the production line, which makes some kinds of modifications of the process (e.g. significant variation of geometry) infeasible. A software framework has therefore been developed for calculation of optimal adjustment of process parameters with respect to customer requirements. The system has been applied in continuous casting of steel, which is described in the present work.

An advanced numerical model has been developed for simulation of the process, based on meshless spatial discretization method with radial basis functions (RBF). The model is combined with an optimization system, which controls its execution within optimization loop and enables flexible definition of the criteria that should be met by the casting process. Furthermore, the optimization process can be facilitated by replacing expensive numerical model by approximation of process outputs by an artificial neural network (ANN). With the described approach, numerical simulations needed in optimization process are prepared in advance, upon which the ANN-based approximation models of response functions are built. When process parameters must be adjusted according to new requirements, search for optimal parameter values is performed on response functions produced by the surrogate ANN model. Evaluation of approximated response is fast enough that the overall optimization procedure is applicable to design of process parameters in conditions of industrial production.

Further steps are being made towards simultaneous optimization of the whole process chain in the steel plant[1],[2], where some preliminary results are available. Due to complexity of the process path and data deficiency, it is currently not possible to properly validate the generated models. The current work is concentrated on overcoming this and largely relies on physics based numerical models. A system of ANN-based test models is planned that will be built on the data generated by numerical simulators. The aim is to produce a virtual ANN-based environment that will closely resemble the conditions that are met in the industrial environment. This will enable numerical experimentation and verification of the devised methodologies, and will eventually lead to fulfillment of the ambitious goal of using artificial neural networks to properly adjust process parameters of the complete steel production line in a real life industrial environment.

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