ARTIFICIAL NEURAL NETWORKS for industrial use

COBIK, Laboratory for Advanced Materials Systems www.cobik.si/en/

At COBIK, we are performing top level research directed towards development of industrial solutions based on artificial neural networks. We are targeting applications in a wide variety of fields such as material production and processing (e.g. steel, aluminium and carbon nanomaterials), sensory systems, chemical industry, and others. Models are developed, used and analyzed either on basis of industrial data or data produced by physics based models. Benefits include gaining additional insight into the modeled processes, support to development of other numerical models in terms of validation and interpretation of model response, real-time evaluation of different realizations of the process, and automatic optimization of process parameters.

ALGORITHMS & SOFTWARE

Development of advanced algorithms is of great importance for success when dealing with complex industrial problems. We invest in research and study of numerical algorithms for training of neural networks, analysis of data and validation of the obtained results.

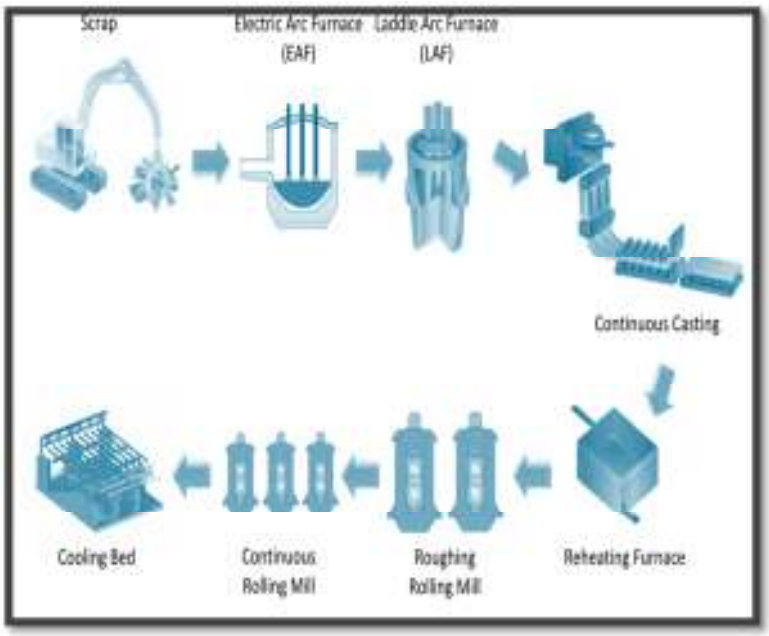

Figure 1: Example of process path – steel manufacturing.

This is a key to our ability to perform high level research and efficiently produce results that are sought by our industrial partners. Our software is based on innovative concepts developed through 20 years of experience with developing solutions for scientific and technical use. Incorporating a number of advanced approaches for rapid application development and quality assurance, its unique feature is also emphasis on fusion of academic and commercial worlds.

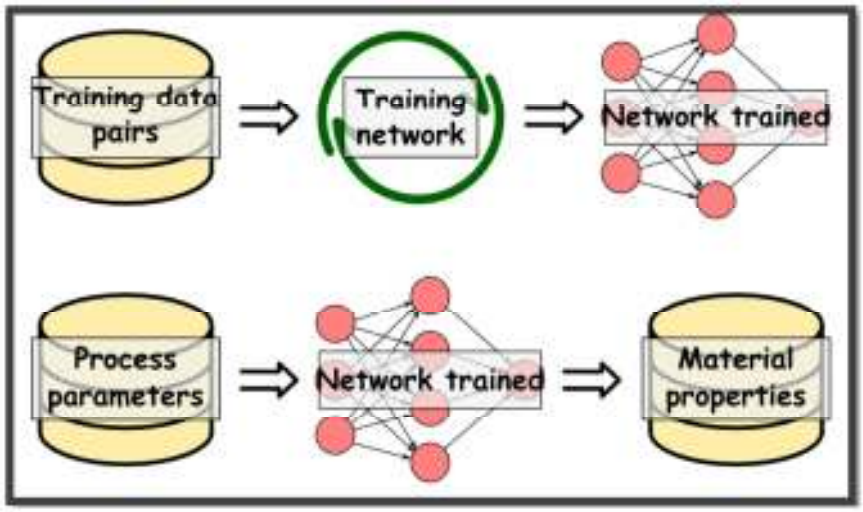

Figure 2: Sophisticated software supports flexibility and agility in providing working solutions.

SOLUTIONS

Our work is interdisciplinary. It begins with profound study of expert knowledge in the field of application, and continues with tight collaboration with industrial partners, as it is shown on the example of modeling the steel production process chain. The complete process is first analyzed in terms of influential parameters and outputs. An ANN model is built based on industrial data, and model details are further elaborated for the casting part by aid of a numerical simulator.

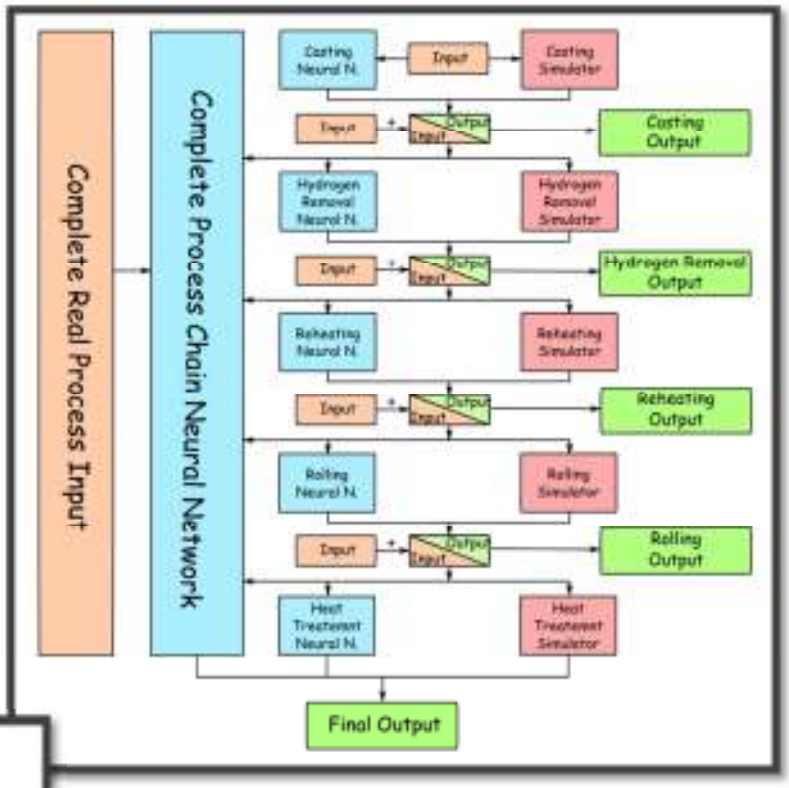

Figure 3: Steel manufacturing process - modeling strategy.

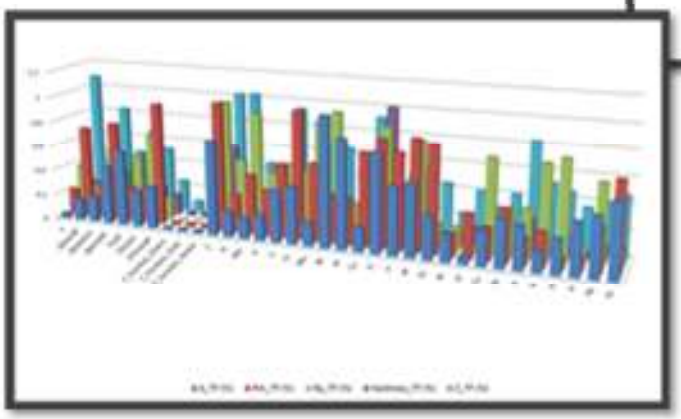

Figure 4: Results, comparative sensitivity tests.

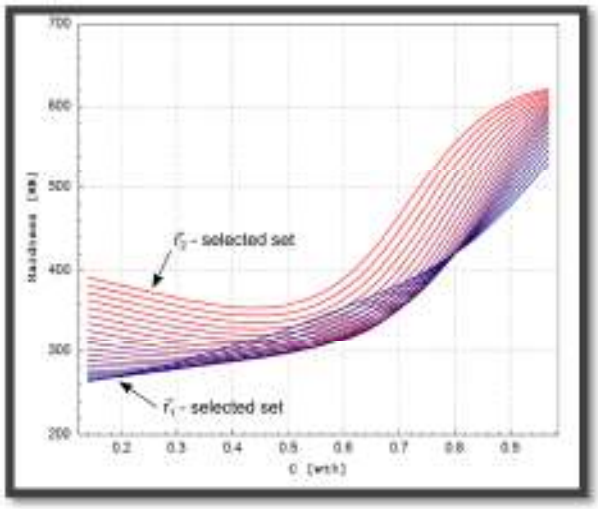

Figure 5: Results, influence of carbon fraction on steel hardness.

BENEFITS FOR INDUSTRY

- Better understanding of the process
- Fast estimation of changes in production route
- Optimization of quality and productivity

REFERENCES

- Grešovnik, I.; Kodelja, T.; Vertnik, R.; Šarler, B. (2012): A software framework for optimization parameters in material production. Applied Mechanics and Materials, vol. 101, pp. 838-841.
- Grešovnik, I.; Kodelja, T.; Vertnik, R.; Senčič. B.; Kovačič, M.; Šarler, B. (2012): Application of artificial neural networks in design of steel production path. Computers, Materials and Continua, vol. 30, pp. 19-38.