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 full 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 & PROCEDURES

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 convergence paths obtained in a study of impact of network architecture and training parameters on the results and speed of
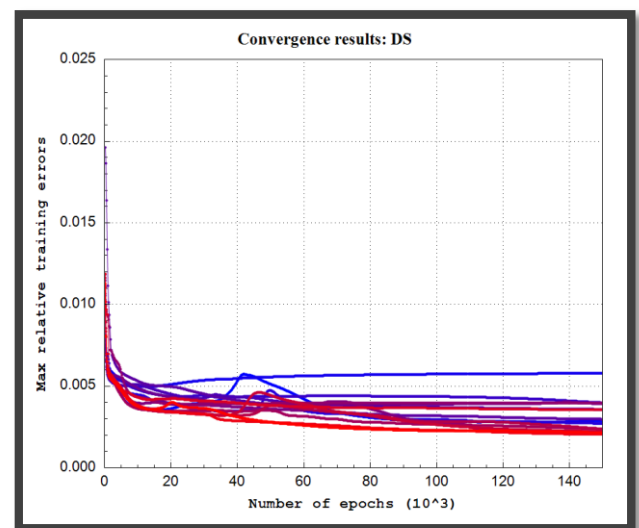
SOFTWARE

Dedicated software development 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, a unique feature is also emphasis on fusion of academic and commercial worlds, which encourages quick transfer of new knowledge and cutting edge technologies into practice while neither academic freedom nor industrial necessity for protection of intellectual property and trade secrets are restrained.

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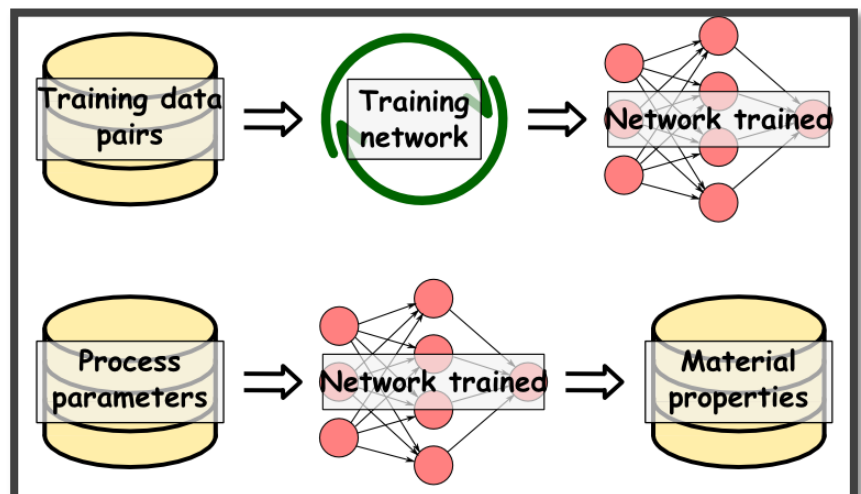
SOLUTIONS

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.

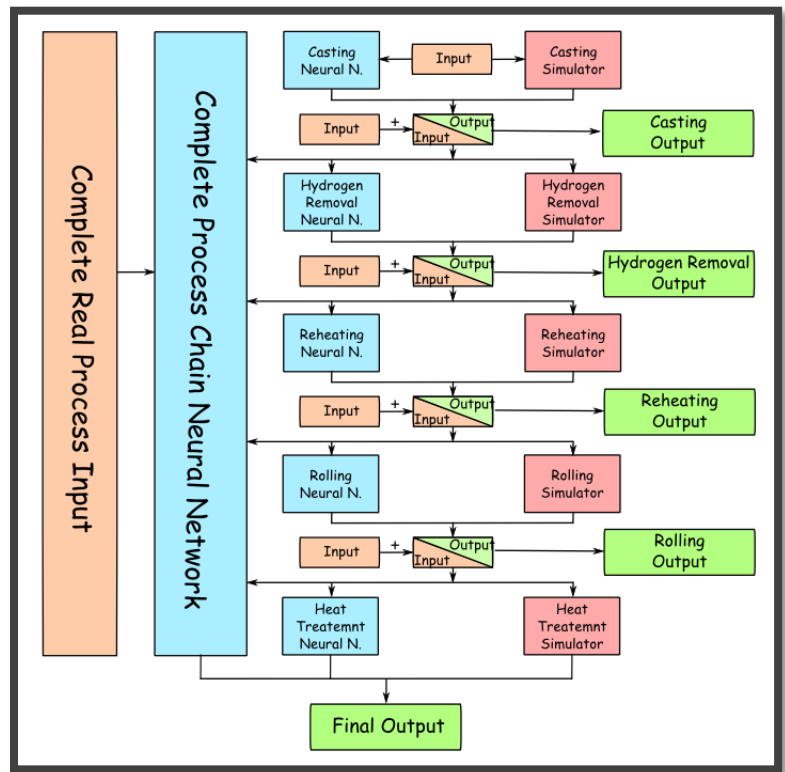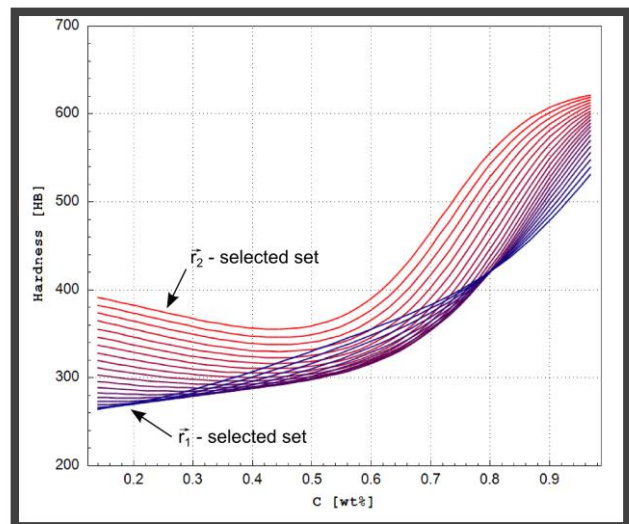**Figure 3:** Continuous casting of steel.
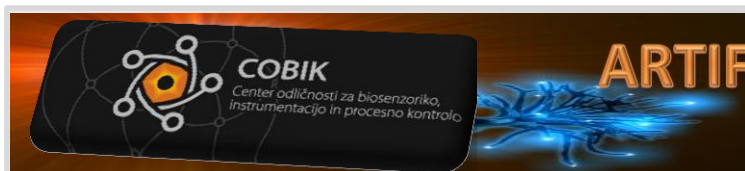**Figure 4:** Steel manufacturing process modeling strategy.
Figure 5: Results, sensitivity tests.

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.; Šarler, B. (2012): Application of artificial neural networks to improve steel production process. Bruzzone, A. G.; Hamza, M. H. Proceedings of the 15th International Conference on Artificial Intelligence and Soft Computing, Napoli, Italy, pp. 249-255.
- Kodelja, T.; Grešovnik, I.; Vertnik, R.; Šarler, B. (2012): Topmost steel production design by using artificial neural networks through process modeling, 20th jubilee conference on materials and technology, Portorož, Slovenia.
- 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.
- Grešovnik, I. (2012): IGLib.net - investigative generic library. Available at: http://www2.arnes.si/~ljc3m2/igor/iglib/
- Grešovnik, I. (2012): IOptLib – library for solving inverse and optimization problems. Available at: http://www2.arnes.si/~ljc3m2/igor/ioptlib/

Igor Grešovnik & Tadej Kodelja, COBIK   **http://www.cobik.si/en/**

COBIK
Center odličnosti za biosenzoriko, instrumentacijo in procesno kontrolo

ARTIFICIAL NEURAL NETWORKS
for industrial use