COBIK
Centre of Excellence for Biosensors, Instrumentation and Process Control

Investing in your future
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Project Plan for 2013: ANN Modeling (Project B.16, COBIK)

Revision 6, Jan. 2013

Revision 0: Dec. 2012

Igor Grešovnik, Tadej Kodelja

Contents:

Legend:
TK – Tadej Kodelja
IG – Igor Grešovnik
KM – Katarina Mramor
June + 3M – expected completion date June 2013, can be likely delayed by up to 3 months

1 Plan of Work for 2013 – ANN-based Modeling (Igor Grešovnik & Tadej Kodelja)

Project: B.16

Employed:
Igor Grešovnik – 1700 h
Tadej Kodelja – 1700 h

1.1 Tasks

1.1.1 Development of models

- steelwork production line (most of the work done, detailed investigation going on, report pending (TK & IG, March + 3M))
- continuous casting – process parameters (TK & IG; data generated, detailed study in progress; May + 3M)
    - Preparation of a model for IJS to perform optimization, eventually leading to a common paper, can be done in January or February
- continuous casting – process and material parameters
    - Preparation of material data (IG, TK, first set of data for preliminary testing: May + 3M)
    - Simulator results (IG & TK, June + 3M)
    - 1st model (TK, IG, June + 3M)
    - Detailed investigation & report (IG & TK, September + 4M)
    - Continuation:
        - Derived benchmark test based on the model
        - Improvements of the model for standard steel grades (finer sampling around standard compositions)

1.1.2 Development of tests

- analytical benchmark tests (1D, 2D, multidimensional)
- Software for basic testing & demonstration (IG & TK, June + 3M)
- benchmark tests based on simulation data of an industrial process
    - continuous casting (October + 2M)
    - continuous casting with parameters (November + 2M)

Benchmark tests will be prepared for studying properties of the ANN models, for validation of methodologies, studying errors, and numerical experimentation.

1.1.3 Development and validation of algorithms for industrial – scale ANN modeling

- study of standard ANN algorithms used by current software (TK)
- suggestions for improvement of training algorithms (TK, IG)
- development of quality indicators for spatial distribution of data (IG, TK)

1.1.3.1 Accompanying activities

- development & improvement of basic utilities such as I/O (IG, TK, continuous)
- optimization algorithms (IG)
    - Inclusion of libraries
    - Interfaces
    - Testing utilities
- basic framework for analysis of spatial distribution of samples (IG, since September)
- Interfaces with libraries and Mathematica (IG, start as soon as possible, limited by time)
- other (IG, TK)

1.1.4 Reports and Articles

Reports:

- Model of a steelwork production line (IG, TK, March 2013 + 2M)
- Interface for batch computation of material properties with JMatPro (IG May +3M)
- continuous casting – with emphasis on estimation of model errors (IG, TK, July + 3 M)

- continuous casting with material parameters – emphasis on magnitude of errors & complexity of response (IG, TK, September + 2 M)

Attendance of conferences:

- WCSMO-10 (IG, May)
- ANN international conference (IG, Jul - Nov)
- ANN international conference (TK – Jul - Nov)
- Kuhljevi dnevi (Slovensko društvo za mehaniko - Sept)
- IMT conference (Institute of Materials and Technologies - Oct)

Planned journal papers:

- Modeling of steel production line – Journal of Materials and Technologies (paper prepared by IG & TK, waiting corrections from BŠ)
- Model of continuous casting for a single steel grade (IG & TK, prepared by May 2013 + 4 M)
- Model of continuous casting covering all steel grades from production catalogue (IG & TK, prepared by August + 4 M

1.1.5 Administration

- SVN administration (IG, continuous)
  - Backups
  - Adding/removing repositories
  - Regular checks
  - User Access
  - Cleaning will probably be necessary, possibly deletion and reinstallation of some repositories
- Administration of Servers and Workstations (IG & TK, continuous)
- Project Folder (IG, TK)
  - Gathering and arrangement of material
  - Providing supporting environment for maintaining list of references and contents of "success indicators" (edited by KM)
- Regular reporting (1 month reports)
- **Other?** A list of other tasks should be prepared, with expected dates and assignments.
- Assessment of conditions to fulfill the plan. The plan is based on the assumption that work will be concentrated on accomplishment of tasks, satisfactory working conditions are provided (e.g. necessary equipment purchased, work is not hindered by excessive bureaucracy, relevant information promptly and clearly spread downwards the hierarchy, etc.), there is no other unexpected work that would affect the working process, crucial information is provided enough in advance, etc. Assessment will be made at least twice, planned in May and in September.

1.1.6 Commerciaization

- Prepare presentation material on achievements (TK & IG, since September)
- Create initial list target partners (IG, TK, BŠ, since August)
- Establish contacts, organize meetings (IG, TK, BŠ, since September)

1.2 Milestones

M ANN.1 – Review of plan execution. Assess whether working conditions necessary to follow the plan are met, expose critical problems, eventually propose solutions. July 2013.

M ANN.2 – Preliminary results available from JMatPro calculations. Assess achievements and applicability of generated data for ANN-based modeling of continuous casting with material parameters included; decide further steps. July 2013.

M ANN.3 – Overview of currently applied algorithms, definition of further development strategy. September 2013

M ANN.4 – Overview of accessible simulators that can be used in further cases (such as rolling or electromagnetic stirring), assessment of their capabilities relevant for ANN modeling and their applicability in future ANN modeling. Suggestion of models to be built on basis of these simulators, taking into account the current situation. November 2013.

1.3 Acquisition of Equipment

Equipment listed below should be **purchased as soon as possible**. Most of the equipment was needed since the beginning of work on the project (September 2010), but has not been acquired due to financial limitations.

- Extreme Optimization Library - 2 licenses (single user, unlimited time)
- Mathematica – 2 licenses (single user, unlimited time)
- UPS
- Disc (2x 2 GB USB - powered)
- Keyboard + mouse + monitor
- Telephone – apparatus + connection (IG’s office)

1.4 Beyond 2013

Increase the number of publications based on past & new work

- more detailed investigation and improvement of existent models
- benchmark testing
- development and application of improved algorithms

Expand the set of problems that are solved

- by access to additional simulators (e.g. rolling, electromagnetic stirring)
- by access to new industrial data
- by more close integration with automatic optimization, sensitivity analysis and statistical analysis

Develop market for developed knowledge

- establish cooperation with industrial partner institutions
- explore commercial potential together with partner institutions
- systematic search for new customers and partners
- engage in international research
- seek for market in new industrial branches other than steel production
- develop collaboration with developers of automation and simulation software