

MASTER DEGREE THESIS

Spring 2018

for

Student: Menno Kemp

Modernised GUI and Automated optimizing of hydropower schemes for nMag

BACKGROUND

The Norwegian hydropower system is aging and built for another market than is expected to be dominant in the future. Modernising, reconstructing and renovation of the hydropower system is thus both necessary and a way to increase efficiency and adaptation to a new market situation. Hydropower systems are complex and complex simulation tools are necessary to embrace all effects of changes in a hydropower system. Such tools exist at different levels. nMag is one of these simplest models and is feasible for all, from small student projects to larger hydropower schemes in a prefeasibility study. nMag is also useful for different other analyses of a hydropower system. Tools that are more complex are available, but these are at an expert level and not feasible at a prefeasibility level of a project. The available version of nMag has an inefficient and “unmodern” user interface and nMag does not have any automated optimizing available. All optimization has to be carried out manually.

TASK

Develop a new GUI and an automated optimizing tool for nMag

Task description

1. Redo the existing GUI for nMag.
2. Develop an Optimizer for nMag
3. Test and validate GUI and Optimizer

Objective and purpose

The objective is to make nMag more user friendly and modern in the design. And to implement an optimizer to expand the use of the model.

Subtasks and research questions

1. Carry out a literature review giving an overview of system design and optimization
2. Redo the existing GUI for nMag.
 - a. Develop a new GUI written in Python that handles all user input to the model and prepare the input file for the simulator, runs the simulator, exports and presents the simulation results.

- b. Develop a visual interactive presentation of the setup of the simulated system based on user input and a translator that presents system setups based on nMag setup/simulation files ("two way translator")
 - c. Develop a translator from NVE Atlas to nMag (if time available)
 - d. Test and validate the GUI and the translator using existing setup
 3. Develop an optimizer for nMag
 - a. For optimizing system design and capacities
 - b. For testing and optimizing operation strategies for different markets, water users and different restrictions
 - c. Test and validate

The report shall be on an article format. Approximately 20 pages and structured as an article ready for publication.

General about content, work and presentation

The text for the master thesis is meant as a framework for the work of the candidate. Adjustments might be done as the work progresses. Tentative changes must be done in cooperation and agreement with the professor in charge at the Department.

In the evaluation thoroughness in the work will be emphasized, as will be documentation of independence in assessments and conclusions. Furthermore the presentation (report) should be well organized and edited; providing clear, precise and orderly descriptions without being unnecessary voluminous.

The report shall include:

- Standard report front page (from DAIM, <http://daim.idi.ntnu.no/>)
- Title page with abstract and keywords. (template on: [wiki page for students at CEE Departement](#))
- Preface
- Summary and acknowledgement. The summary shall include the objectives of the work, explain how the work has been conducted, present the main results achieved and give the main conclusions of the work.
- The main text.
- Text of the Thesis (these pages) signed by professor in charge as Attachment 1.

The thesis can as an alternative be made as a scientific article for international publication, when this is agreed upon by the Professor in charge. Such a report will include the same points as given above, but where the main text includes both the scientific article and a process report.

Advice and guidelines for writing of the report is given in "Writing Reports" by Øivind Arntsen, and in the departments "Råd og retningslinjer for rapportskrivning ved prosjekt og masteroppgave" (In Norwegian) located at [wiki page for students at CEE Departement](#)

Submission procedure

Procedures relating to the submission of the thesis are described in DAIM (<http://daim.idi.ntnu.no/>). Printing of the thesis is ordered through DAIM directly to Skipnes Printing delivering the printed paper to the department office 2-4 days later. The department will pay for 3 copies, of which the institute retains two copies. Additional copies must be paid for by the candidate / external partner.

The master thesis will not be registered as delivered until the student has delivered the submission form (from DAIM) where both the Ark-Bibl in SBI and Public Services (Building Safety) of SB II has signed the form. The submission form including the appropriate signatures must be signed by the department office before the form is delivered Faculty Office.

Documentation collected during the work, with support from the Department, shall be handed in to the Department together with the report.

According to the current laws and regulations at NTNU, the report is the property of NTNU. The report and associated results can only be used following approval from NTNU (and external cooperation partner if applicable). The Department has the right to make use of the results from the work as if conducted by a Department employee, as long as other arrangements are not agreed upon beforehand.

Tentative agreement on external supervision, work outside NTNU, economic support etc.

Separate description is to be developed, if and when applicable. See [wiki page for students at CEE Department](#) for agreement forms.

Health, environment and safety (HSE) <http://www.ntnu.edu/hse>

NTNU emphasizes the safety for the individual employee and student. The individual safety shall be in the forefront and no one shall take unnecessary chances in carrying out the work. In particular, if the student is to participate in field work, visits, field courses, excursions etc. during the Master Thesis work, he/she shall make himself/herself familiar with "Fieldwork HSE Guidelines". NTNU student HSE policy is found here: <https://innsida.ntnu.no/hms-for-studenter>

If you are doing labwork for your project og master thesis, you have to take an online e-course in lab HSE. To get link, email kontakt@ibm.ntnu.no.

The students do not have a full insurance coverage as a student at NTNU. If you as a student want the same insurance coverage as the employees at the university, you must take out individual travel and personal injury insurance.

Start-up and submission deadlines

Start-up and submission deadlines are according to information found in DAIM.

Professor in charge: Oddbjørn Bruland**Other supervisors: Knut Alfredssen, Ånund Killingtveit**

Department of Civil and Transport Engineering, NTNU

Date: 12.01.2018, (revised: dd.mm.yyyy)



Professor in charge (signature)