Form for DKE Student Project Websites

This is the form to be filled for your student project website. To simplify the procedure as much as possible and to make sure that only approved content gets on the website we use this form. Please send the filled form by email to your project supervisor.

* Provide at least one (good quality) image/figure together with this form. Accepted image formats are JPEG, PNG, and GIF. Images should be included in this form (use a lower resolution if needed) so that the editor knows which image is where. Images (provide good quality!) should also be provided as SEPARATE files through a download link. Name images like this: year\_name\_img\_num where name is the last name of (one of) you and num is a number starting from 1. E.g. 2016\_Miller\_img\_1.jpg
* To be uploaded to the website, your report should be provided through a download link. Reports should be provided in the format PDF. Name reports like this: year\_name\_report where name is the last name of (one of) you. E.g. 2016\_Miller\_report.pdf
* You can accompany your report with movies. Movies to be uploaded on your website should be provided through a download link. Movies should be provided in the format MPEG4. Name movies like this: year\_name\_mov\_num where name is the last name of (one of) you and num is a number starting from 1. E.g. 2016\_Miller\_mov\_1.mp4
* Your final presentation should be provided through a download link. Presentations should be provided in the format PDF. Name presentations like this: year\_name\_presentation where name is the last name of (one of) you. E.g. 2016\_Miller\_ presentation.pdf
* Provide all references in the APA standard. See e.g. <https://scholar.google.com/> for examples. Citations should be done using the author name, year. For instance: [Weiss et al., 2015]

**Type of project (e.g. Bachelor thesis, Master AI thesis, Master OR thesis, Master AI internship project, Master OR internship project, Master AI semester project, Master OR semester project):**

Master Research Project

**Year of project:**

2018-2019

**Key words (5 max):**

optimization, feasibility, root finding, Newton Method, Ariadne

**Name(s) of student(s) who participated in the project:**

Martyna Mikos, Tahmina Begum, Casper Hogenboom, Demet Demirkiran, Edwin van der Vegt

**Name(s) of supervisor(s):**

Pieter Collins

**Title of the project:**

Checking for Collisions: Validating Optimality/Feasibility

**Download link for additional content (at least 1 image/figure, report, final presentation, maybe some movies):**

<https://www.dropbox.com/sh/u519vsysfr532pk/AADrUdOYrLUaLtnUIHCImJ6Sa?dl=0>

**Captions of images/figures. Enter your images (in low resolution if needed) here as well with appropriate captions:**

Fig. 1. Newton method

**Problem statement and motivation. Please provide a general description of the problem that you worked on, a short description of why this is relevant, and a few sentences that state precisely what you aimed at:**

In safety critical systems (SCS), it is of particular importance that the risk of errors is made negligible. Such systems are used in a broad area of applications, including medical devices, train- aircraft-control, weapon and nuclear systems. In general, all new technological applications will have some form of SCS built in. The level of risk differs in these applications: financial loss or even loss of life can be a result of a wrong assessment in SCS. In SCS the prior goal is to find an accurate solution in least computational time possible. This is an application where non-rigorous algorithms can be used to lower the computational cost. The non-rigorous algorithm should maintain high accuracy by validating the approximate solution. The context of this report is the verification of approximated solutions for non-rigorous optimization algorithms. Research problem: Can we validate a given approximation by proving the existence of a real solution 'nearby'?

**Research questions and/or hypothesis: explain the questions/hypothesis that you addressed during your project:**

In the present project we aimed at answering the following research questions:

* How will we identify an initial estimator or initial box for the true solution?
* What is an appropriate notion of "nearby"?
* How can we find the approximations of one dimensional cases?
* How can we use our method in multidimensional cases?
* How can we improve the initial bounds on the solution?

**Major outcomes of your project. Please provide up to seven major outcomes of your project. These should be formulated in a clear but compact way:**

* Implementation of:
* Newton Method
* Root finding algorithm
* Interval Newton Method

**References: Provide possible references you are using in your text in the APA standard. Use e.g. Google Scholar to obtain references in the correct format:**

Jaulin, L., Kieffer, M., Didrit, O., & Walter, E. (2001). *Applied interval analysis*. Springer-Verlag London.

**Any additional information you would like to be mentioned:**

Ariadne installation on different computers produced different seemingly uncorrelated errors and was very time consuming.

**To be filled by supervisors (dear supervisors: delete what you do not want):**

◻ I agree that this project is posted on the DKE student projects webpage. (Feel free to make any modifications to the text/material provided by your students.)

◻ I agree that the final project report is uploaded to the DKE student projects webpage.

◻ I agree that the final presentation is uploaded to the DKE student projects webpage.

◻ I agree that movies provided by the students are uploaded to the DKE Youtube channel and shown on the DKE student projects webpage.