THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Arc detector in DC grids**
Author's name:	**Valerija Vukosavljević**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Measurement
Thesis reviewer:	Jiří Smutka
Reviewer's department:	STMicroelectronics, Pobřežní 3, Praha 8

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment — **challenging**

The Arc detector is perspective topic, probably required in DC installation expanding in coming years. The development of complete arc detector prototype can be done on different levels. The challenging point is mainly algorithm differentiating between "normal operating condition" and arc condition. However, other parts of detector, it means analog and digital signal processing and data presenting, represents also in some parts challenging engineering work.

Fulfilment of assignment — **fulfilled with minor objections**

Autor has fulfilled the specification on basic level. She has built an analog circuit for basic signal processing including data collection, filtering, signal gain setting and digitalization. The hardware implementation was done on universal board. The position of components can be probably optimized to improve better noise immunity level. The part of development was basic data analysis and proposal of algorithm for arc detection. This algorithm was successfully tested using scope on several sets of data. Based on this analysis the software for prototype has been implemented. It consists from programing of STM32 and upper software providing final processing and displaying using Python tool. The part of software development was also establishing of communication between STM32 board and higher level system with Python.

Methodology — **correct**

The thesis shows the author worked over different topics from analog signal collection up to software design. She worked successfully with laboratory tools like scope, software tool development, schematic design software. The most challenging point of such work is algorithm detecting the arc. Selected method based on the FFT analysis expecting the arc current signal contains large area of harmonics sum can work, but there is missing comparison with more variations of different no arc signals. It is not fully guaranteed this algorithm would not detect in specific cases non arc signal.

Technical level — **C - good.**

Student shows capability to do different type engineering work like basic analog circuit design, software development, measuring, she worked with schematic/PCB design tool. Checking the software added to thesis indicates also appropriate work on the software level. Unfortunately, some parts of work are not well described reducing possibility to comment well. It makes sense to highlight following points:

- The analysis of arc and no-arc signals is discussed in chapter 5. There is missing an exact explanation how this test was proceeded. It is not clear what exact circuit was applied, what tool was used to simulate arc, what devices were used for testing, what type of signals/loads was used for operation with and without arc.
- There is missing deeper description of final solution used for communication in chapter 6.
- The description of results in chapter 6 is too short. For instance, there is shown quite clear measurement in time domain in Fig 6.2. It can be expected this signal can be used for good recognition of arc. On the other hand, the conclusion of the chapter is the arc detection failed mainly due to noise level. But the measurements showing and analyzing such signals are missing.

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Formal and language level, scope of thesis	**C - good.**
The text of thesis is written in level well describing step by step the design evolution. The weak point of formal level, including partly confusion, are several measurement charts. Some waveforms described in chapter 5 have probably wrong definition of Y axes unit. For instance, there is measured noisy signal of current with amplitude peak-peak in range 5A in figure 5.5. There is also visible FFT result for same signal, but the amplitude is in range of several kA. Probably the Y axis unit has to be in mA and not in A. This issue is quite frequent, and it makes source of confusion. For instance, the measurement shown in figure 5.6 in time domain shows peak level of current in range > 100A. As low voltage source with limited current capability was probably used this current level seems to be not real. The question is – is it typo in axis description or very high noise inducted into shunt voltage measurement or mistake in recalculation of the shunt impact?	

Selection of sources, citation correctness	**B - very good.**
The literature listed in thesis refers well to this topic.	

Additional commentary and evaluation (optional)
Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.
No additional comments.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

The thesis shows the author is able to work on engineering level for wide range of activities including analog design and software development. She shows stronger skills in the software development range. There is good overview in analog signal area, but she need to collect additional practical experiences.

In summary. The work was completed, but the detector does not work well, some results looks bit confusing consequently it is unclear how good or bad are the results and there is missing detail description of some important part of work in the thesis text. Therefore the final mark is C.

Question. Measurements collected with shunt visible in figures 5.5 to 5.7 shows noise signal with high level of amplitude – for non arc in several A and for arc even in hundreds A. On the other side amplitude measured before by scope (fig 5.2, 5.3) shows noise below 1A. What shunt resistivity has been used for measurements visible in figures 5.5 – 5.7? Do you have an explanation for such a difference in noise level measurement in figures 5.2-5.3 versus 5.5 – 5.7?

The grade that I award for the thesis is **C - good.**

Date: **16.6.2023** Signature: