Master of Science Thesis in Electrical Engineering
Department of Electrical Engineering, Linköping University, 2020

Investigations of a problem

N N och M M

Master of Science Thesis in Electrical Engineering

Investigations of a problem:

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LiTH-ISY-EX--YY/NNNN--SE

Supervisor: **Doktorand Si**
ISY, Linköpings universitet
Ingenjör Så
Company

Examiner: **Lena Lärare**
ISY, Linköpings universitet

Division of Automatic Control
Department of Electrical Engineering
Linköping University
SE-581 83 Linköping, Sweden

Abstract

If your thesis is written in English, the primary abstract would go here while the Swedish abstract would be optional.

Acknowledgments

TODO

Linköping, Maj 2019
Jonatan Gezelius

Contents

Notation

Några mängder

Notation	Betydelse
$\mathbb{N}$	Mängden av naturliga tal
$\mathbb{R}$	Mängden av reella tal
$\mathbb{C}$	Mängden av komplexa tal

Förkortningar

Förkortning	Betydelse
ARMA	Auto-regressive moving average
PID	Proportional, integral, differential (regulator)

1

Introduction

For a product to be put on the market there are many regulations which the product must follow, e.g. electrical safety, material regulations, electromagnetic compatibility (EMC), radio regulations etc. To test products against these requirements in a unified manner, standards are used. A standard defines how a product should be tested and the accepted result that need to be achieved in order to ensure that the product complies with all the regulations. There are many standards for many different types of regulations and usually a single product must comply with several of these. It is also common that one standard references another standard, or specific parts of another standard, instead of redefining some tests.

The ISO 7637 standard, *Road vehicles – Electrical disturbances from conduction and coupling*, is an international standard that apply to products in road vehicles with a supply voltage of 12 V or 24 V. The standard states, here put in a very condensed form, that the product shall withstand a sufficient amount of disturbances applied to the power supply. The reason for this is that there can be many voltage surges and much noise in a vehicle's power supply lines. In general, the source of disturbances and noise in a vehicle origins from inductance in other devices connected to the power line, the cables and the vehicles alternator. [**?**]

To test if a product comply with this standard, there is equipment which simulates different events on the power supply. The standard defines the different scenarios, raise and fall times of pulses, repetition times etc. It also defines the functional requirements of the equipment during these tests for what is considered a passed or a failed test. [**?**]

1.1 Motivation

The standard defines all the timing requirements that must be met, and also specifies the load conditions for which the requirements apply [**?**]. From time to time

the standards are revised with updated requirements, which might differ from previous versions of the standard. New equipment is guaranteed by its manufacturer to do the tests according to the latest standard, as long as it is regularly sent in for calibration and maintenance. New equipment costs a great amount of money and might not even be affordable by smaller test labs, and can thus inhibit labs from performing the tests.

An appealing alternative would be the possibility to reuse the test equipment that was used along with the older revision of the standard, as long as it is capable of performing sufficient tests reliable. For this to be of any value the test equipment must be verified in some way to be able to guarantee that the tests are performed according to the new standard.

1.2 Aim

The goal of this work is to investigate the potential of reusing test equipment made for an old standard, with the newer revised version of that standard, and how to assure that the test results are reliable.

The verification of the system is desired to be automated. This automated verification procedure is also part of the goal.

1.3 Research questions

The following questions will be answered in this paper:

1. How should the test equipment be verified to give a robust result?
2. How much differences are there in a real implementation compared to a simulated system?
3. What considerations must be made when automating the verification system?
4. ——- OLD STUFF FOLLOW, TODO REMOVE STUFF
5. Can test equipment for ISO 7637-2:2004 of the standard be used for testing compliance with the newer ISO 7637-2:2011 standard?
6. Is the reused system more cost effective than investing and maintaining a new test system?

1.4 Delimitation

This paper only compares the standard ISO 7637-2:2004 to 7637-2:2011. The area of interest here is the specification of the test pulses and how these are verified. Whether a product test is considered as pass or failure, which is also specified in the standard, is not of interest in this paper.

This paper only considers the following test equipment for the real implementation that is available for this project:

Model	Description
EFT 200A	Burst generator
MPG 200B	Mocropulse generator
LD 200B	Load dump generator
CNA 200B	Connection Network

Though the methods used should be applicable to other similar standards and equipment.

1.5 Report structure

TODO

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Theory

This chapter contains all the necassary theory.

2.1 Test pulses

3

Resultat

Det här är kapitlet där resultaten presenteras.

3.1 Ditten

Liksom [**?**] har vi kommit fram till att glass smakar bäst på sommaren.

När vi nu går in på hur glass smakar vid olika tidpunkter under dagen hänvisar vi till figur **??**, och speciellt till figur **??**. Jämför sedan med figur **??** för att se hur det kan bli när man äter glass vid okontrollerade tidpunkter.

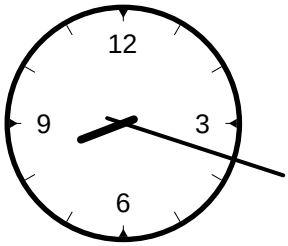
Veselić, Krešimir (Veselić, Krešimir) skrev en gång en artikel med titeln *Bounds for exponentially stable semigroups*.

Kommer att tänka på en liten anekdot...

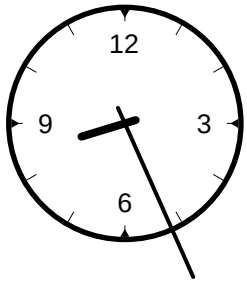
TODO:
Ta bort den löjliga anekdoten!

3.2 Framtiden

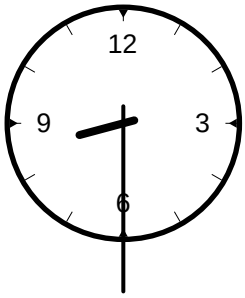
Sen när glassen är uppäten är det bara till att sätta igång och skriva på exjobbet igen!



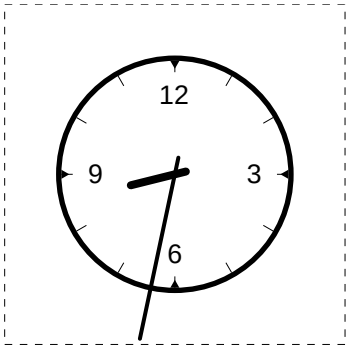
(a) *Det här är väl tidigt — din glass hinner smälta innan ditt sällskap dyker upp.*



(b) *Kiosken stänger snart, men inte nu — perfekt!*



(c) *Precis i tid — du får in ett finger i luckan just när kiosken ska stänga. Han som jobbar blir sur, och det blir smolk i bägaren.*



(d) *Du är sen — kiosken är stängd.*

Figure 3.1: *Illustration av* subfloats. *Den så kallade* bounding box*en visas i* **??**. *Lägg märke till att bounding boxen har satts så att alla bilder har samma storlek, med enhetlig placering av själva innehållet i förhållande till bounding boxen. Antag att du ska träffa en kompis för att äta glass just när kiosken stänger för dagen vid 08:30. När dyker du upp?*

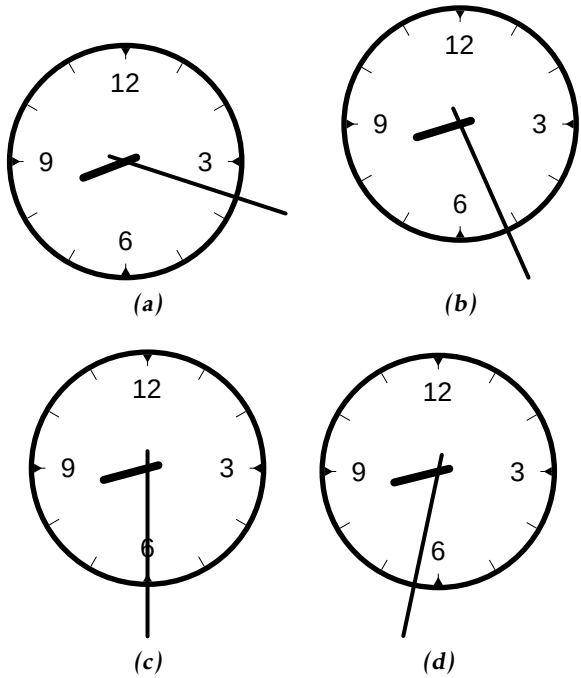


Figure 3.2: *En andra illustration av* subfloats. *Den här gången har bounding boxen gjorts så liten som möjligt runt själva innehållet. Resultatet är stökiga placeringar på sidan. Samma sak kan hända med vanliga fyrkantiga figurer när man har text som spretar ut åt lite olika håll från själva rutan med kurvor i.*

Appendix

3.A Ett par långa bevis

Det här är en appendix-del av det aktuella kapitlet.

Appendix

A

Trista saker

Långa beräkningar brukar bli rätt trista…

Detta är ett appendix-kapitel. Jämför med appendixet i kapitel **??**.

A.1 Bädda sängen

Den här beräkingen är så trista att vi kallar den *att bädda sängen*.

A.2 Diska

Den här beräkingen är så trista att vi kallar den *att diska*.