TÉCNICO LISBOA

Fast response MPPT switched charger for the Técnico Solar Boat

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Introduction to the Research in

Electrical and Computer Engineering

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Abstract

Resumo do trabalho
Keywords: MPPT, MPPT topology, DC-DC Converter

Contents

Acronyms

IST	Instituto Superior Técnico
TSB	Técnico Solar Boat
MPPT	Maximum Power Point Tracker
MPP	Maximum Power Point
PCB	Printed Circuit Board
CAN	Controller Area Network
USB	Universal Serial Bus
GUI	Graphical User Interface

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Introduction

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1.1 Motivation

As the world is reaching a point where pollution is taking over all news over the world, solar panels are one of the main solutions available. In 2024, 7% of the energy produced in the world comes from solar panels, and in Portugal this number rises to 14.5% [**?**]. Solar energy still plays a miniscule role that it is listed behind the other sources of energy in terms of the contribution for meeting the world's energy demand. But as the years go by, solar energy is becoming more and more relevant, with the cost of solar panels dropping significantly in the last decade.

In comparison to other forms of alternate energy, Photovoltaic energy is relevant due to its availability, simplicity, lower maintenance, environmental friendliness, reliability and many other benefits. More recently, is becoming more and more relevant in the automotive industry, with solar powered cars, boats and robots being developed for both competition and commercial purposes. And that is where the **tsb!** (**tsb!**) project fits in.

In 2015, **tsb!** was created with the goal of designing and building a solar powered boat to compete in international competitions. Since then the project has growth and built several vessels. It begined with the construction of the first prototype, São Rafael 01 wich had alot of room to improvement and there by São Rafael 02 and 03 were built.

All of these prototypes used solar energy to maximize their range and efficiency. In the first years the energy produced was not much and the all system were commercial available. But as a team of students that want to push the limits of solar power boats and the overall technology, the "built your self" philosophy was presented all over the years. And that is why we started building our own solar panels in 2020 for São Rafael 03. As the years went by, a lot of other systems were designed and built in house but there is still one system that is yet to be developed, the **mppt!** (**mppt!**).

The **mppt!** is a fundamental part of any solar energy system. Its main goal is to maximize the energy extracted from the solar panels by operating them at their **mpp!** (**mpp!**). This is done by adjusting the electrical operating point of the modules or array.

1.2 Background

de maneira a complementar o cap 1.1 vou explicar alguns conceitos basicos sobre paines solares, MPPTs e o projeto TSB

1.2.1 Solar Panels

1.2.2 MPPTs

1.2.3 TSB Project

1.3 Objectives

Explicar os objetivos do projeto com bulet points.

1.4 Outline

Explain how the work is organized by chapters.

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State-of-the-Art

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Intro if needed

2.1 mppt! algorithms

Escolher algumas para falar

2.1.1 Constant Voltage (CV)

2.1.2 Fractional Open Circuit Voltage (FOCV)

2.1.3 Fractional Short Circuit Current (FSCC)

2.1.4 Perturb and Observe (P&O)

2.1.5 Incremental Conductance (IncCond)

2.1.6 Method beta

2.1.7 Method based on temperature

2.2 MPPT converter topology

Intro..

Escolher algumas para falar

2.2.1 Buck Converters

2.2.2 Boost Converters

2.2.3 Buck-Boost Converters

2.2.4 Sepic Converters

2.2.5 Half-Bridge Converters

2.3 Comercial mppt!s

Table with comercial MPPTs and some of their carateristics.

2.4 Battery charging unit

2.5 Protection circuits

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Solucion Proposal

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3.3 Current and Voltage Sensing 10

3.4 Power electronics 10

3.1 Microntroller

Explicar a escolha do microcontrolador, o que ele faz, etc

3.2 Communication

sensors, CAN, USB, GUI

3.3 Current and Voltage Sensing

pq que é necessarion, e o que é que escolhi

3.4 Power electronics

Topologia escolhida, pq, vantagens e componentes

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Preliminary Work

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Planning and Scheduling

Fazer um planeamento com um gantt chart e explicar as decisoes

Bibliography

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Appendix Name