Science and Technology English I

Exercise 108 Meiji University 2020

(DICS Chapter-2 ,Junction / Diode)

EX_108.pptx 11 Slides November 22nd.,2019

http://mikami.a.la9.jp/mdc/mdc1.htm

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Inbound (Reading) 演習のすすめ方

EX_107 再掲+α

- Chapter 1 では技術的内容に深入りせず概要の理解に集中します。
- 1.制限時間を決めて(基本4分/A4で1ページ)配布テキスト原文(赤ナシ)を最後まで読み切る。(最低でもワンパラグラフ単位 – 30~50行程度)
- 2.わからない単語があったら下線を引いてパス、英単語のままで読み進む
- 3.最後まで読み切ったら(できれば)もういちど繰り返す
  - ホントは何回も繰り返しているうちに内容がわかってきます
  - これは人間の脳に備わる能力です。*読書百篇義自ずから通ず*
- 4.続いてEX1_1XX –このテキストの(赤入れ)単語訳つきの英文を読んでみます
- 5.これでだいたいわかったら Outbound 演習にすすみます。
- まだ不明単語が多いと思う場合は、このテキストの打ち直しテキストを自動翻訳サイトにコピペして訳させてみます。納得いかない単語がある場合は辞書引いてみます。そして Outbound にすすんでください。Chapter2以降はポイントになる技術点などは、資料で解説します(技術的内容を読み取る演習になります)

ねらい
逐次和訳しようとする
日本語脳をブロックします

Outbound (Writing) 演習のすすめ方

EX_107 再掲

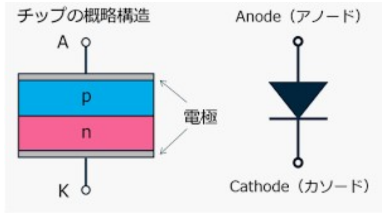
ねらい
行単位での逐次英訳和訳
ではなく、内容をまとめて
書き出せるようにします

- EX_課題 和文または英文で概要をまとめよ　の場合
- 和文でまとめる場合は、読み取った英語理解イメージから、日本語で作文をするようなイメージで書き出してください。(書いた日本文を和文英訳サイトを使ってみて、どのように英訳されるかを試してもいいです。)
- 英文でまとめる場合は、読み取った英語理解イメージから、英作文をするようなイメージで Sentences を書き出してください。日本語訳を間に入れないようにするのがポイントです。(日本語翻訳脳をブロックするイメージです。これは Native 同様の英語->英語プロセスです)
- 完成した英文は自動翻訳(和訳)サイトの英文入力側に張り付けて、エラーチェックして、赤い波線が出るところを直します。Wordなども使えます。このときチェック機能は完全なものではありませんから技術用語などはエラーのままでかまいません。
- 注意：一行単位で和訳しないように。英語本文をそのまま抜き出してコピペしないように。パラグラフやページ単位で理解したものを書き出していくイメージ。

技術解説 P/N 型半導体

周期表 https://www.ptable.com/?lang=ja　4つの力 価電子

- 半導体 Si (14ケイ素) Ge(26ゲルマニウム) 4価
- 5価の不純物ドナー(リン、ヒ素など)を加えるとN型半導体(キャリア-電子)に
- 3価の不純物アクセプタ(ホウ素、アルミニウムなど)を加えるとP型半導体(キャリア-ホール)に
- P型とN型の半導体を接合すると**ダイ**オードができる(**di**-2極)
- ダイオードは一方向にのみ電流が流れる(整流作用)
- ダイオードの電圧降下は0.6V(順方向電圧)
- トランジスタは、E(Emitter),C(Collector),B(Base) 3極-tri
- PNP型とNPN型がある



ダイオードとは | 半導体製品 | 新電元工業株式会社- ...
shindengen.co.jp

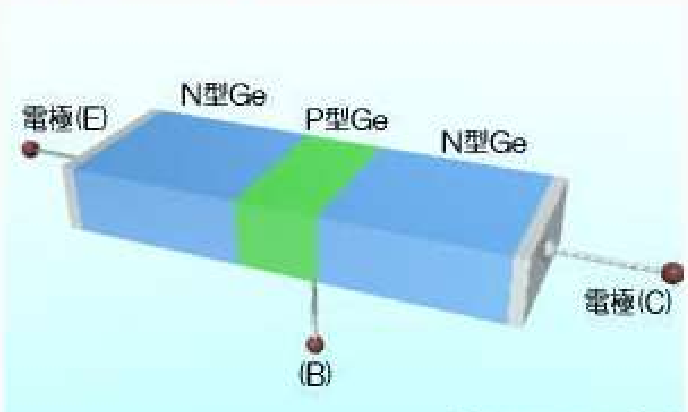
数の接頭辞
1:mono-
2:di-
3:tri-
4:tetra-
5:penta-
6:hexa-
7:hepta-
8:octa-

- 右図は,EX_101 から再掲
- 接合(ジャンクション)
- ダイオードはPとNの2極接合
- トランジスタは3極接合

数の接頭辞
1:mono-
2:di-
3:tri-
4:tetra-
5:penta-
6:hexa-
7:hepta-
8:octa-

図のように、金属針(E)にプラスの電圧を、金属針(C)にマイナスの電圧をかけたとき、電極(B)の電圧次第で、E(emitter)とC(collector)の間に電流が流れたり流れなかったりすることが分かったのだ。これこそ、現在「**バイポーラトランジスタ**」と呼ばれているものの原型だった。今では、このトランジスタを「**点接触型トランジスタ**」と呼んでいる。この理論の確立にはバーディーンが大きく貢献した。

この発見を聞いたショックレーは、動作が不安定だった点接触型トランジスタを改善して、「**接合型トランジスタ**」を考案している。ちなみにトランジスタというのはベル研によって作られた名前だが、もともとは"transfer+resistor（電気を伝える抵抗素子）"という言葉からきている。



接合型トランジスタ

この三人は56年にトランジスタの発明・開発の業績を評価され、ノーベル物理学賞を受賞している。

2.1 Introduction

- It is a well-known premise in engineering that the conception of a complex construction without a prior understanding of the underlying building blocks is a sure road to failure. This surely holds for digital circuit design as well. The basic building blocks in this engineering domain are the silicon semiconductor devices, more specifically the diodes, and the MOS and bipolar transistors.
- Giving the reader the necessary knowledge and understanding of these devices is the prime motivation for this chapter. It is not our intention to present an in-depth discussion (we assume that the reader has some prior familiarity with electronic devices). The goal is rather to refresh the memory, to introduce some notational conventions, and to highlight a number of properties and parameters that are particularly important in the design of digital gates. We further identify the fundamental differences between bipolar and MOS transistors that helps to explain the differences in the topology of digital circuits manufactured in those technologies.
- Another important function of this chapter is the introduction of the device models. Taking all the physical aspects of each device into account when designing complex digital circuits leads to an unnecessary complexity that quickly becomes intractable. Such an approach is similar to considering the molecular structure of concrete when constructing a bridge. To deal with this issue, an abstraction of the device behavior called a model is typically employed. A range of models can be conceived for each device presenting a trade off between accuracy and complexity. A simple first-order model is useful for manual analysis. It has limited accuracy but helps us to understand the operation of the circuit and its dominant parameters. When more accurate results are needed, complex, second- or higher-order models are employed in conjunction with computer-aided simulation. In this chapter, we present both first-order models for manual analysis as well as higher-order models for simulation for each device of interest.

2.1 Introduction

前提

領域

It is a well-known premise in engineering that the conception of a complex construction without a prior understanding of the underlying building blocks is a sure road to failure. This surely holds for digital circuit design as well. The basic building blocks in this engineering domain are the silicon semiconductor devices, more specifically the diodes, and the MOS and bipolar transistors.

記号、符号　協定、協約

両立しないことについて妥協を得る

Giving the reader the necessary *knowledge and understanding of these devices* is the prime motivation for this chapter. It is not our intention to present an in-depth discussion (we assume that the reader has some prior familiarity with electronic devices). The goal is rather to refresh the memory, to introduce some notational conventions, and to highlight a number of properties and parameters that are particularly important in the design of digital gates. We further identify the fundamental differences between bipolar and MOS transistors that helps to explain the differences in the topology of digital circuits manufactured in those technologies.

位相幾何学　手に負えない

Another important function of this chapter is the introduction of the *device models*. Taking all the physical aspects of each device into account when designing complex digital circuits leads to an unnecessary complexity that quickly becomes intractable. Such an approach is similar to considering the molecular structure of concrete when constructing a bridge. To deal with this issue, an abstraction of the device behavior called a *model* is typically employed. A range of models can be conceived for each device presenting a trade-off between accuracy and complexity. A simple first-order model is useful for manual analysis. It has limited accuracy but helps us to understand the operation of the circuit and its dominant parameters. When more accurate results are needed, complex, second- or higher-order models are employed in conjunction with computer-aided simulation. In this chapter, we present both first-order models for manual analysis as well as higher-order models for simulation for each device of interest.

1次モデル

支配的な

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- Designers tend to take the device parameters offered in the models for granted. They should be aware, however, that these are only nominal values, and that the actual parameter values vary with operating temperature, over manufacturing runs, or even over a single wafer. To highlight this issue, a short discussion on process variations and their impact its included in the chapter.
- Since this text focuses on the design aspect of digital integrated circuits, a mere presentation of an analytical model of a device is not sufficient. Turning a conceived circuit into an actual implementation also requires a knowledge of the manufacturing process and its constraints. The interface between the design and processing world, is captured as a set of design rules that act as prescriptions for preparing the masks used in the fabrication process of integrated circuits. The design rules for a representative IC process are introduced in Appendix A to this chapter. A detailed description of IC fabrication processes is beyond the scope of this textbook.

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概観、側面

変動

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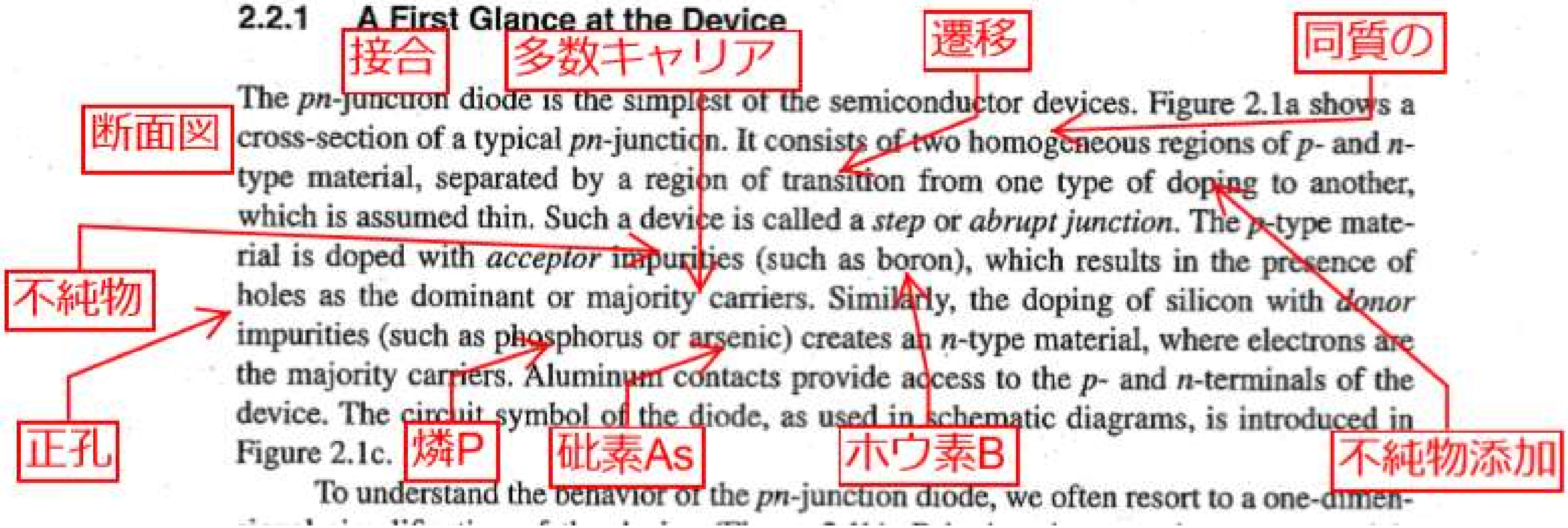
処方箋

- The pn-junction diode is the simplest of the semiconductor devices. Figure 2. la shows a cross-section of a typical pn-junction. It consists of two homogeneous regions of p- and n-type material, separated by a region of transition from one type of doping to another, which is assumed thin. Such a device is called a step or abrupt junction. The p-type material is doped with acceptor impurities (such as boron), which results in the presence of holes as the dominant or majority carriers. Similarly, the doping of silicon with, donor impurities (such as phosphorus or arsenic) creates an n-type material, where electrons are the majority carriers. Aluminum contacts provide access to the p- and n-terminals of the device. The circuit symbol of the diode, as used in schematic diagrams, is introduced in Figure 2.1c.
- STE-101-202 To understand the behavior of the pn-junction diode, we often resort to a one-dimensional


2.2.1 A First Glance at the Device

The *pn*-junction diode is the simplest of the semiconductor devices. Figure 2.1a shows a cross-section of a typical *pn*-junction. It consists of two homogeneous regions of *p*- and *n*-type material, separated by a region of transition from one type of doping to another, which is assumed thin. Such a device is called a *step* or *abrupt junction*. The *p*-type material is doped with *acceptor* impurities (such as boron), which results in the presence of holes as the dominant or majority carriers. Similarly, the doping of silicon with *donor* impurities (such as phosphorus or arsenic) creates an *n*-type material, where electrons are the majority carriers. Aluminum contacts provide access to the *p*- and *n*-terminals of the device. The circuit symbol of the diode, as used in schematic diagrams, is introduced in Figure 2.1c.

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Exercise: EX_108

EX_108-1：Slide 06~09 (原本p18~19)までを読んで、和文または英文でここまでの要点を短くまとめてください(どのようなことをテーマにしているか) -箇条書きでもかまいません。

- 注1:自動和訳(翻訳)サイトを使ってもいいですが、その前に必ず英文を通読してください。
- 注2:英文で提出する場合は事前に自動翻訳サイトで、エラーチェックをかけてください。
- 注3:速く読み概要を掴む演習なので、正確さにとらわれてストップしないようにしよう。
- 提出はClass Web “レポート” にて水曜まで

Memo

フォローアップURL (Revised)

http://mikami.a.la9.jp/meiji/MEIJI.htm

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