# On Non-polar Token-Pass Brownian Circuits

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# 1 Einführung

Some text in a section.

# An unnumbered section

## A subsection

Some text.

### A subsubsection

More text.

**A paragraph** Even more text.

## 2 Die verschieden Schaltkreis Arten

### 2.1 Token-based Schaltkreise

### 2.2 Polar Token-Pass Schaltkreise

### 2.3 Non-polar Token-Pass Schaltkreise

## 3 1-Bit Memory mit polar Token-pass (8 T-Elemente) und non-polar Token-pass (7 T-Elemente)

## 4 Boolsche Funktionen mithilfe von non-polar Token-Pass

### 4.1 Negation

### 4.2 Logisches ODER

### 4.3 Logisches UND

## 5 Ausblick

## 6 Important hint

If you don't know LaTeX, how to use math mode, environment, and so on, a short tutorial/introduction will be more useful than this document. This document is only a reminder of some basic LaTeX stuff. Not the absolute basics, and nothing advanced.

Furthermore, use a **suitable editor**. This will make using LaTeX *much* easier.

## 7 Basic usage of LaTeX

### 7.1 `\newcommand` for shorthands

Using `\newcommand{\cmdname}{output}` you can define shorthands, e.g., `\IN` for natural numbers $\mathbb{N}$, and so on. See the preamble. Much more than mere text insertion is possible. See (advanced) LaTeX introductions.

### 7.2 Lists

Use `itemize`, `enumerate` or `description` for lists. For example (itemize):

- First item
- Second item

## 7.3 Math environments

Use *inline* math mode (i.e., tex code in $'s) for inline math, e.g., $\lim_{x\to 1} e^{2\pi i x} = 1$ or $\alpha\beta = \Gamma$. Use the `equation*` environment (or `\[` and `\]`) for math in *display* mode, e.g.,

$$\lim_{x\to 1} e^{2\pi i x} = 1.$$

If you use `equation` you get numbered equations which you can reference to (see section 7.4).

$$|x| = \begin{cases} -x & \text{if } x < 0 \\ x & \text{otherwise} \end{cases} \tag{1}$$

Proofs, Definition, Lemmata, Propositions, Theorems, Remarks, etc, have their own environments. Environments can be be changed/redefined and new ones can be defined.

**Definition 1** (Negligible function)**.** Let $f\colon \mathbb{N} \to \mathbb{R}$ be a function. If for any $k > 0$, it holds that $f(x)x^k \to 0$ for $x \to \infty$, then we call $f$ *negligible*.

**Lemma 2.** $f(x) = 0$ *is a negligible function.*

**Proposition 3.** *If $f$ and $g$ are negligible functions, then $f + g$ is a negligible function.*

The following theorem has a proof included.

**Theorem 4** (The ring of negligible functions)**.** *The set of negligible functions is closed under addition, subtraction and multiplication.*

*Beweis.* This is just an application of theorems about limits of series and induction. For example, $0 = 0 + 0 = \lim_{x\to\infty} f(x)x^k + \lim_{x\to\infty} g(x)x^k = \lim_{x\to\infty}(f(x) + g(x))x^k$ and

$$0 = 0 \cdot 0 = \lim_{x\to\infty} f(x)x^k \lim_{x\to\infty} f(x)g(x))x^k = \lim_{x\to\infty}(f(x)g(x))x^{2k}$$

$\square$

**Corollary 5.** *Working with negligible functions is easy.*

*Remark* 6. If $f$ is *not* negligible, this does *not* imply that $|f(x)| \geq x^{-k}$ always. This needs to hold for infinitely many $x \in \mathbb{N}$ (and $k > 0$). E.g., $f(x) = 1 - (-1)^x$ is not negligible.

There are a lot more useful things for math layout, e.g., `align` and `aligned` environments for equations, and so on.

## 7.4 References

To refer to a section, or any other "referrable" object, use the "ref" command. For example: Section 1 or Definition 1 or Eq. (1). The tilde ~ is an "unbreakable space". (There are more advanced ways to do this, which are especially useful for longer documents. For example the "cleveref" package.)

## 7.5 Literature and BibTeX

To refer to literature, use BibTeX (which needs a bib-file) and run it (on the main document). The bibfile is set by `\bibliography{FILENAME}` in the preamble. The literature inserted by the `\printbibliography{}` command. (See the end of the document). A good source of (sample) bibfiles is `https://dblp.uni-trier.de`. Use `\cite{}` (e.g., [**DH76**] or [**RSA78**]) or variants (see Section 7.6).

## 7.6 Packages and the internet

There is a huge supply of useful packages. For almost every problem, there's a package to solve it. Just use the internet to find them. (Special mention: TikZ, cleveref, cryptocode)

Reading some short introduction/tutorial on LaTeX is also recommended. Because this document only scratches the surface: It does not have tables, pictures, splitting the document into multiple files, and so on. Good starting points are: Search engines, `https://en.wikibooks.org/wiki/LaTeX`, `https://tex.stackexchange.com`

## 7.7 Miscellaneous

To start a new paragraph, use either an empty line in the source tex file or the command `\par`.

Footnotes work via the `footnote` command.[1]

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[1]This is a footnote.