BRNO UNIVERSITY OF TECHNOLOGY

FACULTY OF MECHANICAL ENGINEERING
INSTITUTE OF MATHEMATICS

THESIS TITLE
CONTINUATION OF THE TITLE

DIPLOMA THESIS

AUTHOR NAME SURNAME

SUPERVISOR Assoc. Prof. NAME SURNAME, Ph.D.

BRNO 2023

Abstract
A short summary of the thesis.

Keywords
keyword 1, keyword 2,...

Surname, N.: *Title of the thesis*, Brno University of Technology, Faculty of Mechanical Engineering, 2023. xx pp. Supervisor: xxx xxx.

I declare that I wrote the diploma thesis *Title* independently under the guidance of *supervisor's name* using the literature included in the list of references.

Author's name

Here, write a short thanks (to the supervisor, family, close person, etc.).

Author’s name

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1 Introduction

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2 Section

2.1 Limit of a function

Definition 2.1 (limit of a function)**.** We say that a function f has at a point $x_0 \in \mathbb{R}^*$ a *limit* $a \in \mathbb{R}^*$ (and we write $\lim_{x\to x_0} f(x) = a$) if, for any neighborhood $O(a)$, we can find a deleted neigborhood $O^*(x_0)$ such that, for each $x \in O^*(x_0)$, we have $f(x) \in O(a)$.

Remark. a) The definition covers four cases: if $x_0, a \in \mathbb{R}$...

b) Note that the definition uses a deleted neighborhood of x_0, it does not contain any demand on $f(x_0)$.

Example 2.2. Show that $\lim_{x\to 0} f(x) = 0$ where $f(x) = \begin{cases} x^2 & \text{for } x \neq 0, \\ 1 & \text{for } x = 0. \end{cases}$

Solution. Let $\varepsilon > 0$ be arbitrary. Then $\forall x \in O^*_\delta(0)$, where $\delta = \sqrt{\varepsilon}$, it holds $|x^2 - 0| = x^2 < \delta^2 = \varepsilon$.

Theorem 2.3 (Heine[1] condition)**.** *A funtion f has a limit $a \in \mathbb{R}^*$ at the point $x_0 \in \mathbb{R}^*$ $\Leftrightarrow$ for every sequence $\{x_n\}_{n=1}^{\infty} \subseteq D(f)$ such that* $\lim_{n\to\infty} x_n = x_0$*, $x_n \neq x_0$ $\forall n \in \mathbb{N}$, we have* $\lim_{n\to\infty} f(x_n) = a$.

Proof. "$\Rightarrow$" Let $\lim_{x\to x_0} f(x) = a \in \mathbb{R}^*$ and $\{x_n\}$ be a sequence...

"$\Leftarrow$" Assume... □

Basic limits

1. Let $f(x) = c \in \mathbb{R}$ for each $x \in \mathbb{R}$. Then, for any $x_0 \in \mathbb{R}^*$, we have $\lim_{x\to x_0} f(x) = c$.
2. Let P be a polynomial. Then, for arbitrary $x_0 \in \mathbb{R}$, we have $\lim_{x\to x_0} P(x) = P(x_0)$.
3. ...

[1] Heinrich Eduard Heine 1821–1881, German

Tables

Tables should have captions (the command `\caption`) above. At the end of the caption (of both tables or figures) we do not write a dot. One of the typographical rules says that we should avoid vertical lines.

Table 2.1: Laplace transform of selected functions

$f(x),\ x \geq 0$	$\mathcal{L}\{f\}(s)$	$f(x),\ x \geq 0$	$\mathcal{L}\{f\}(s)$
1	$\frac{1}{s}$, $\operatorname{Re} s > 0$	$\sin ax$	$\frac{a}{s^2+a^2}$, $\operatorname{Re} s > 0$
x	$\frac{1}{s^2}$, $\operatorname{Re} s > 0$	$\cos ax$	$\frac{s}{s^2+a^2}$, $\operatorname{Re} s > 0$
x^n,	$\frac{n!}{s^{n+1}}$, $\operatorname{Re} s > 0$	$\mathrm{e}^{ax} \sin bx$	$\frac{b}{(s-a)^2+b^2}$, $\operatorname{Re} s > a$
e^{ax},	$\frac{1}{s-a}$, $\operatorname{Re} s > a$	$\mathrm{e}^{ax} \cos bx$	$\frac{s-a}{(s-a)^2+b^2}$, $\operatorname{Re} s > a$
$x\mathrm{e}^{ax}$,	$\frac{1}{(s-a)^2}$, $\operatorname{Re} s > a$	$x \sin ax$	$\frac{2as}{(s^2+a^2)^2}$, $\operatorname{Re} s > 0$
$x^n\mathrm{e}^{ax}$,	$\frac{n!}{(s-a)^{n+1}}$, $\operatorname{Re} s > a$	$x \cos ax$	$\frac{s^2-a^2}{(s^2+a^2)^2}$, $\operatorname{Re} s > 0$

Figures

Captions of figures (again the command `\caption`) should be placed below the figure, see Fig. 2.1. The preference is to create a vector graphics (optimally in PDF format), e.g., as export from Matlab/Maple software in combination with consequent editing in IPE graphical editor (or similar).

Figure 2.1: FSI logo

For typesetting mathematical environments, it is recommended to use the package "amsmath" (it includes `align`, `alignat`, `gather`, `multline` environments):

$$a^2 + b^2 = c^2. \quad \text{(Do not forget a dot behind the formula.)} \tag{2.1}$$

It follows from (2.1)...

$$\begin{aligned} \lim_{n\to\infty} \frac{a_k n^k + a_{k-1} n^{k-1} + \cdots + a_1 k + a_0}{b_\ell n^\ell + b_{\ell-1} n^{\ell-1} + \cdots + b_1 n + b_0} \\ = \begin{cases} 0 & \text{je-li } k < \ell, \\ a_k / b_\ell & \text{je-li } k = \ell, \\ \pm\infty & \text{je-li } k > \ell \quad \text{(improper limit, will be specified later)}. \end{cases} \end{aligned}$$

The list of references can be created using via the portal "Citace PRO" (`https://www.citacepro.com/vut`), unfortunately, it offers the formats that are not so common in the mathematical disciplines. Citations of the particular references' items are carried out with help of the command `\cite{name-in-bibitem}`, see examples below.

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