



This is the MarpX Spartan Theme

Sometimes it's handy to have a subtitle too

Author's name goes here

Date goes here

Institutional Information goes Here

This is the Marpx Spartan Theme

This is Subtitle in class title

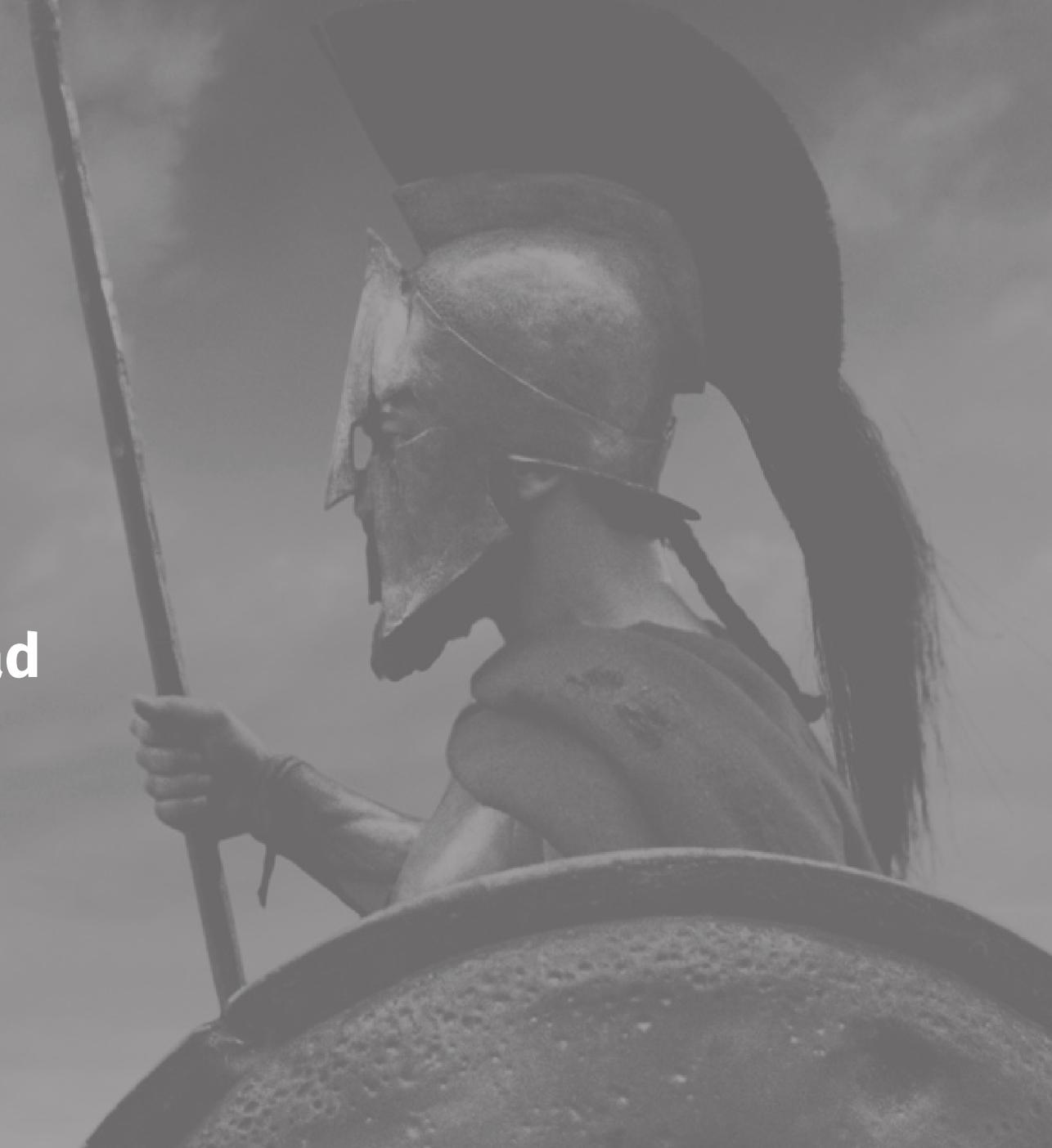
This is the Spartan Theme

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Transition Slide

Additional Text about what's ahead



Is Algebraic Graph Knowledge a Possibility ?

Research has been conducted in order to evaluate the possibility of reaching meaningful knowledge from Algebraic Graph transformations.

- Model Cheking and theorem proving are viable paths.

When the neet to make strong assertions becomes inevitable:

- This is the first way: outstanding assertion!

* Note: This is a very long footnote line intended to test the layout of two.

H1 - H1 level of header

H2 - H2 level of header

H3 - H3 level of header

H4 - H4 level of header

H5 - H5 level of header

H6 - H6 level of header

- This is a fragment o normal text written here in order to exemplify the use of several featrues in CSS.
- This is a fragment o normal text written here in order to exemplify the use of several featrues in CSS.
 - This is one **bold** comment.
 - This is another *italic* comment.

Images

One image slide

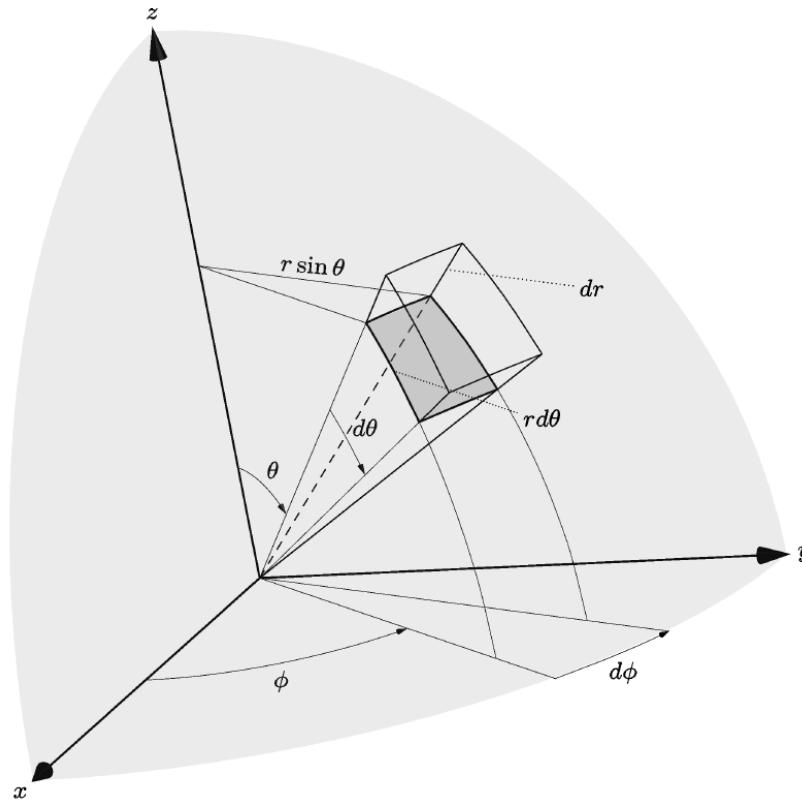


Fig. 8.1: Object defined in terms of spherical coordinates.

Images fit into columns

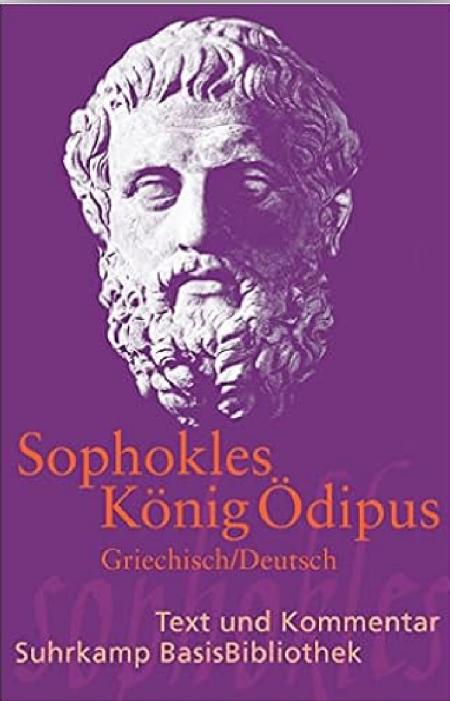


Fig. 9.1: Sophokles, Suhrkamp (2015).

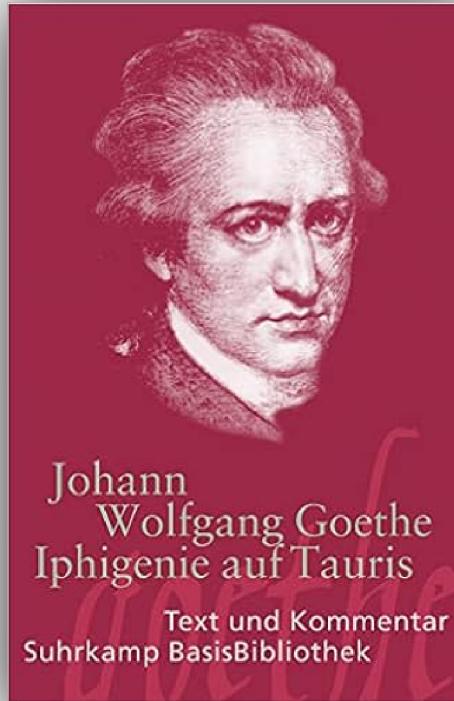
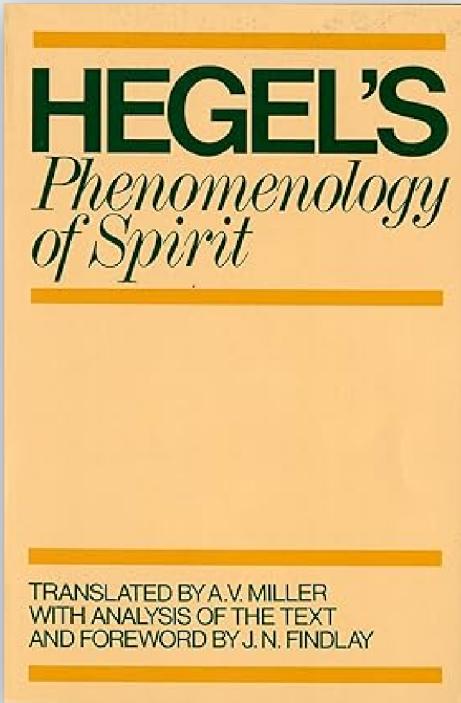


Fig. 9.2: Göthe, Suhrkamp (2011).



Fig. 9.3: Heine, Suhrkamp (2011).

Image and text on the same slide (1)



Hegels Phänomenologie

Das Buch trug ursprünglich den Titel **"Phänomenologie des Geistes"** von seinem Autor: G.W.F. Hegel.

- Das **1807** veröffentlichte Werk markiert eine bedeutende Entwicklung des deutschen Idealismus nach Kant.
- In diesem Buch entwickelt Hegel seine Konzepte der Dialektik.

Fig. 10.1: *Phänomenologie des Geistes* Oxford edition.

Price at Amazon used to be \$ 17.83.

Image and text on the same slide (2)

Kant, Leibniz & Newton

Philosophy and the sciences were closely linked in the age of Leibniz, Newton, and Kant.

This addresses the transformations of metaphysics as a discipline, the emergence of analytical mechanics, the diverging avenues of 18th-century Newtonianism, the body-mind problem, and philosophical principles of classification in the life sciences.

| Price at Amazon used to be 128,39 €

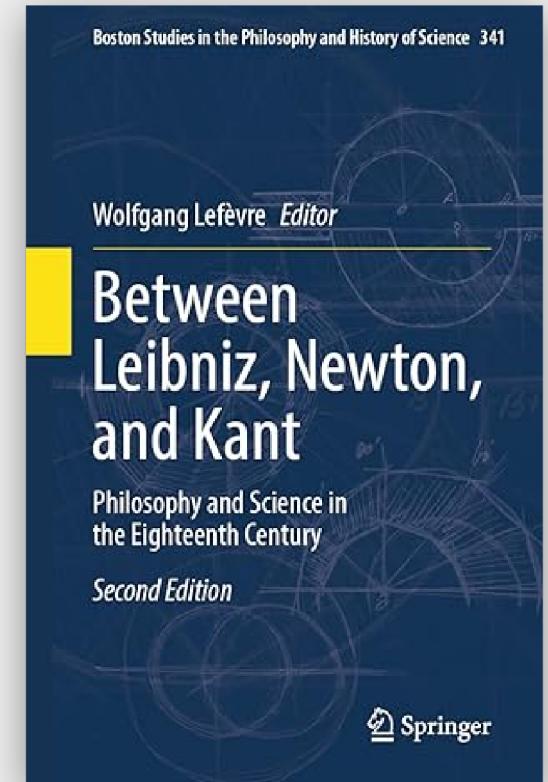


Fig. 11.1: Springer edition (2023).

Multi-images Environment (1)

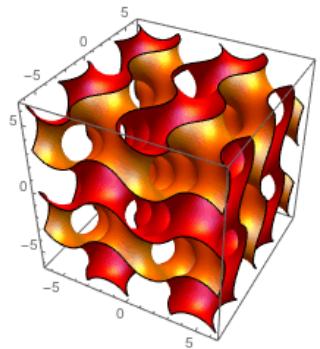


Fig. 12.1: Math001.

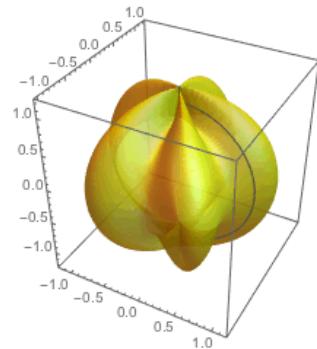


Fig. 12.2: Math002.

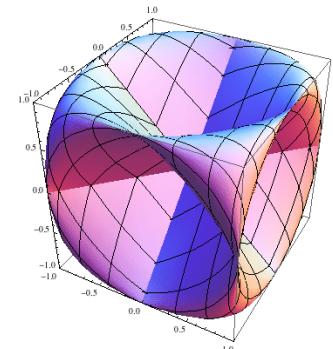


Fig. 12.3: Math003.

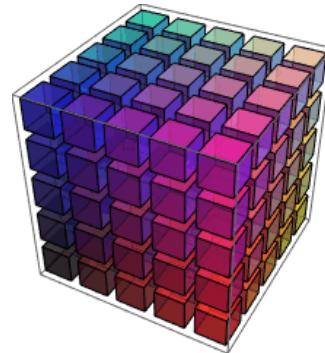


Fig. 12.4: Math004.

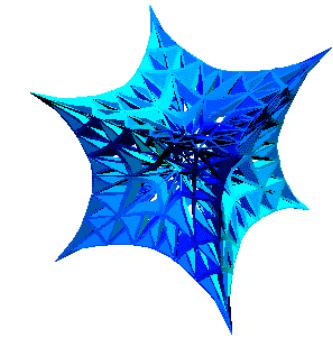


Fig. 12.5: Math005.

Multi-images Environment (2)

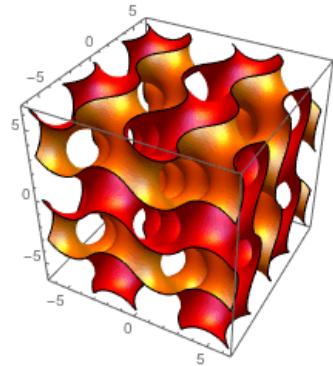


Fig. 13.1: Math001.

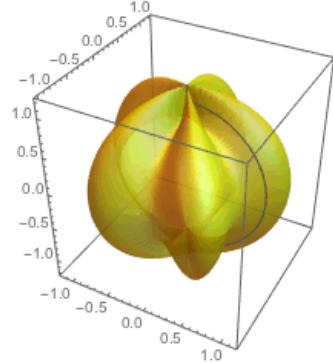


Fig. 13.2: Math002.

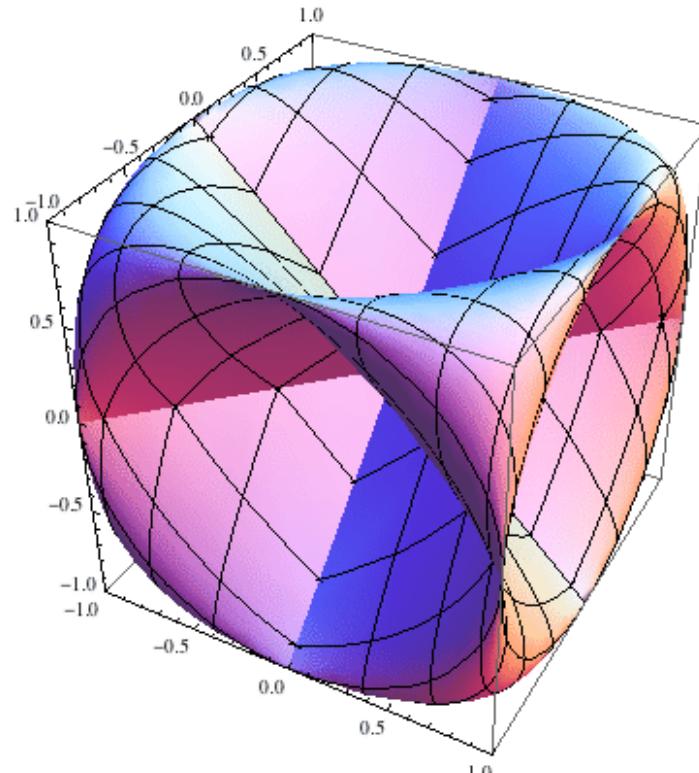


Fig. 13.3: Math003.

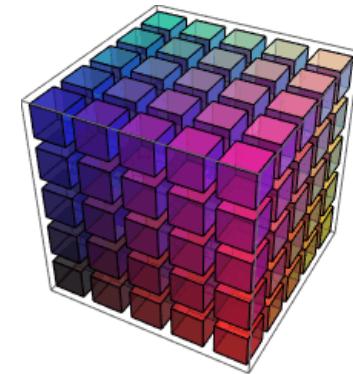


Fig. 13.4: Math004.



Fig. 13.5: Math005.

Figures and caption in *multicolumn*



Fig. 14.1: God Zeus



Fig. 14.2: Afrodite



Fig. 14.3: Dionísio



Fig. 14.4: Era

Animations

Usually works in html only...

Animations (html only!)

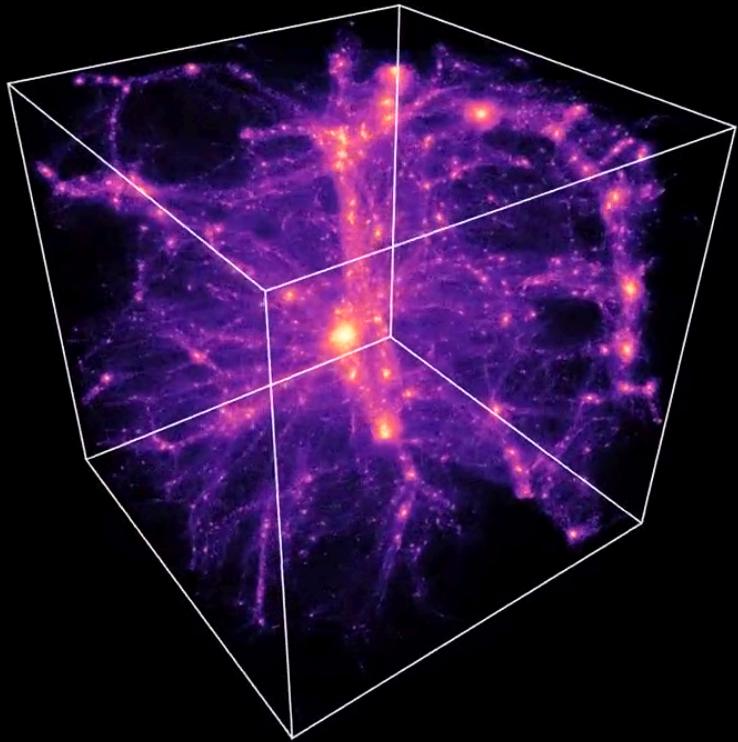


Fig. 16.1: Animation 01.

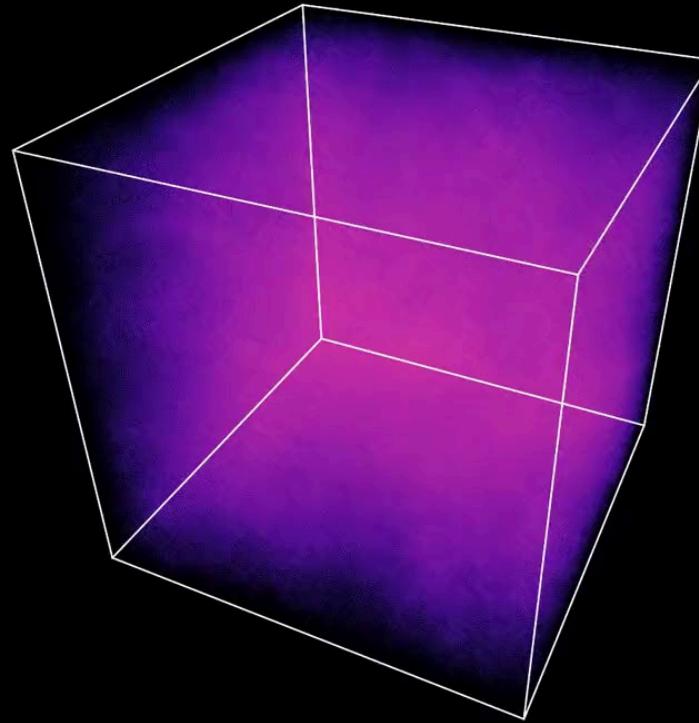


Fig. 16.2: Animation 02.

Video

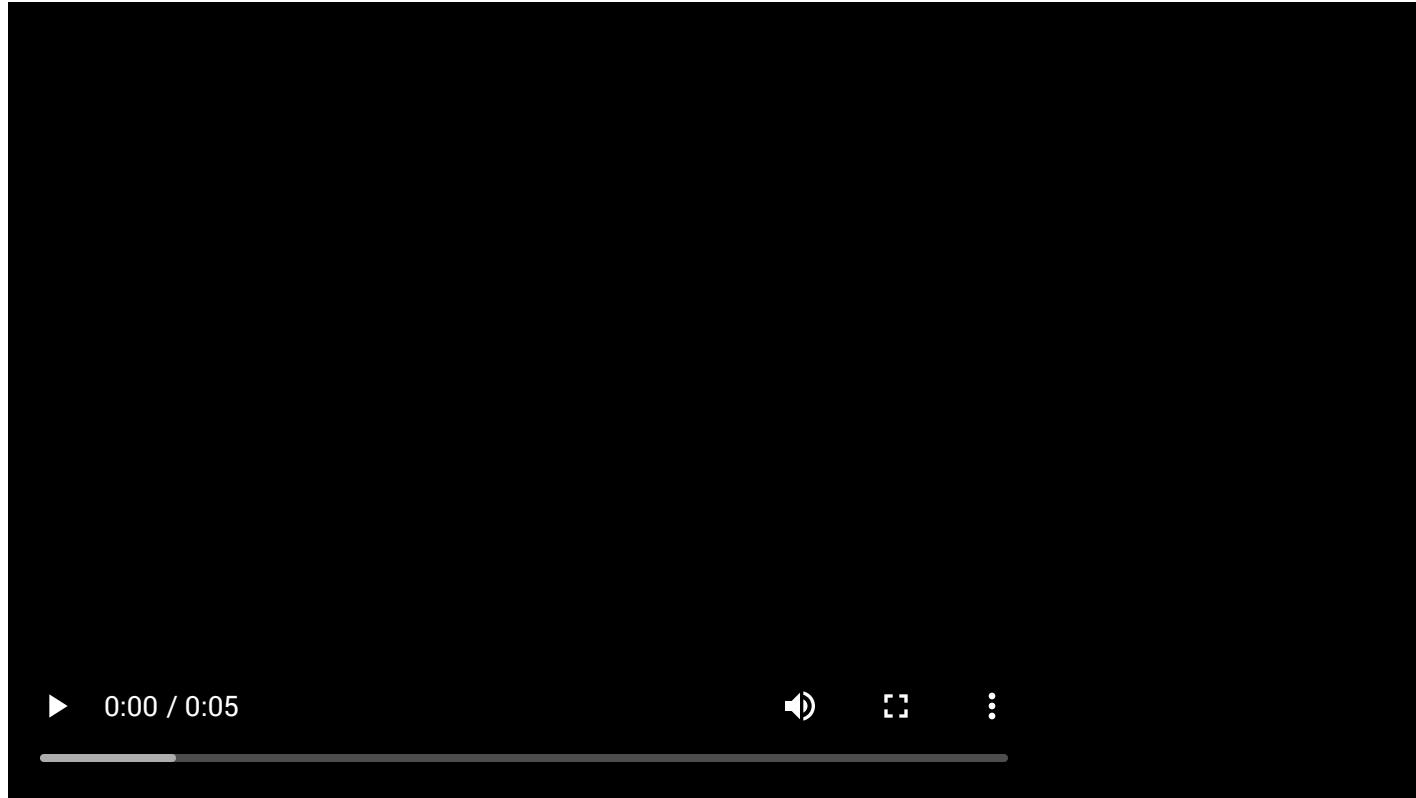


Fig. 17.1: Video playing in Marp available only in html export.

Lists

Ordered and unordered

Ordered and unordered lists

- 1. First object in list;
 - 2. Second object in list;
 - 3. Third object in list;
 - i. First objetc in sublist;
 - ii. Second object in sublist;
 - a. Another level;
 - b. Yet another item.
 - iii. Third object in sublist.
 - 4. Fourth object in List.
- First object in list;
 - Second object in list;
 - Third object in list;
 - First objetc in sublist;
 - Second object in sublist;
 - Another level;
 - Yet another item.
 - Third object in sublist;
 - Fourth object in List;

Tables

Organizing data with tables in Markdown

Renaissance painters

Painter	Country	Birth Year	Death Year	Most Famous Work
Albrecht Dürer	Germany	1471	1528	<i>Melencolia I</i>
Leonardo da Vinci	Italy	1452	1519	<i>Mona Lisa</i>
Michelangelo	Italy	1475	1564	<i>Sistine Chapel Ceiling</i>
Raphael	Italy	1483	1520	<i>The School of Athens</i>
Titian	Italy	~1488	1576	<i>Assumption of the Virgin</i>

Tab. 21.1: Renowned Renaissance painters with biographical data and masterpieces (alphabetical order).

Programming languages

Language	Creator(s)	Year	Main Paradigm(s)
C	<i>Dennis Ritchie</i>	1972	Structured, Procedural
C++	<i>Bjarne Stroustrup</i>	1983	Object-oriented, multi-paradigm
Erlang	<i>Joe Armstrong</i>	1986	Functional, Concorrente
Haskell	<i>Comitê Haskell</i>	1990	Purely Functional
Java	<i>James Gosling</i>	1995	Object-Oriented
Pascal	<i>Niklaus Wirth</i>	1970	Structured, Procedural
Python	<i>Guido van Rossum</i>	1991	Multi-paradigm (OO, Procedural, Functional)

Tab. 22.1: List of programming languages.

Mathematical Formulations

Writing equations with LaTeX

Probability Distribution (1)

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(x - \mu)^2}{2\sigma^2}\right)$$

Fig. 24.1: Normal Distribution (Gaussian).

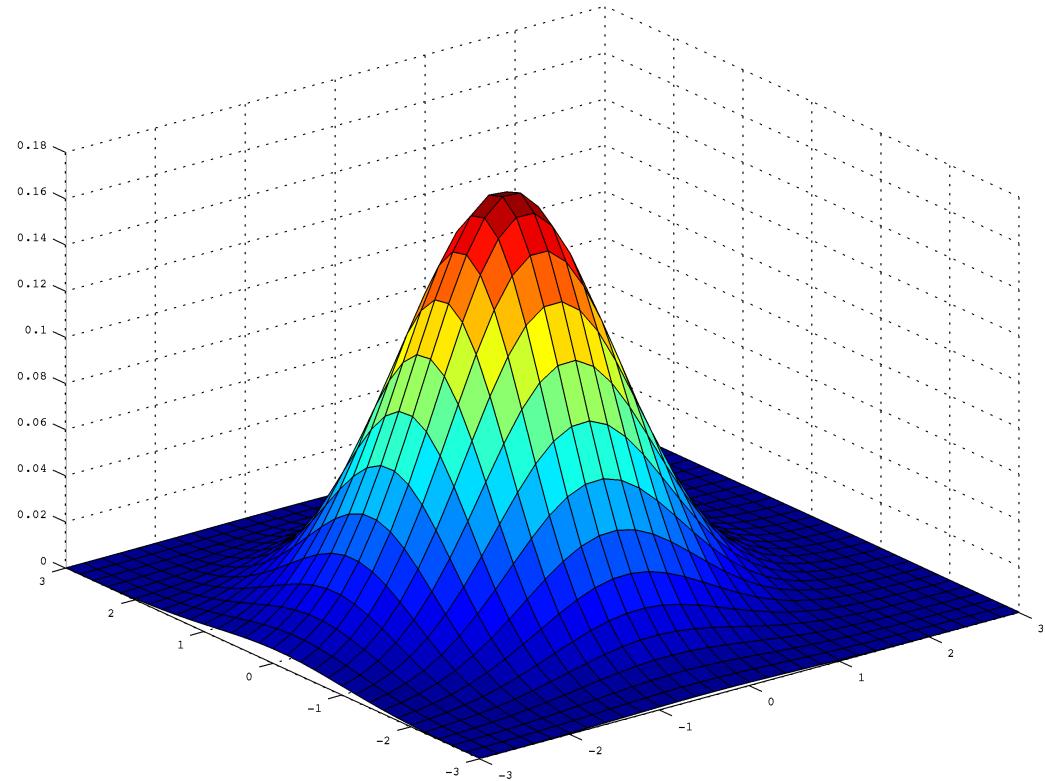


Fig. 24.2: Multivariate Normal Distribution.

Probability Distribution (2)

$$f(x) = \frac{\sqrt{\frac{(d_1 x)^{d_1} d_2^{d_2}}{(d_1 x + d_2)^{d_1 + d_2}}}}{x B\left(\frac{d_1}{2}, \frac{d_2}{2}\right)}$$

Fig. 25.1: Fisher-Snedecor F distribution.

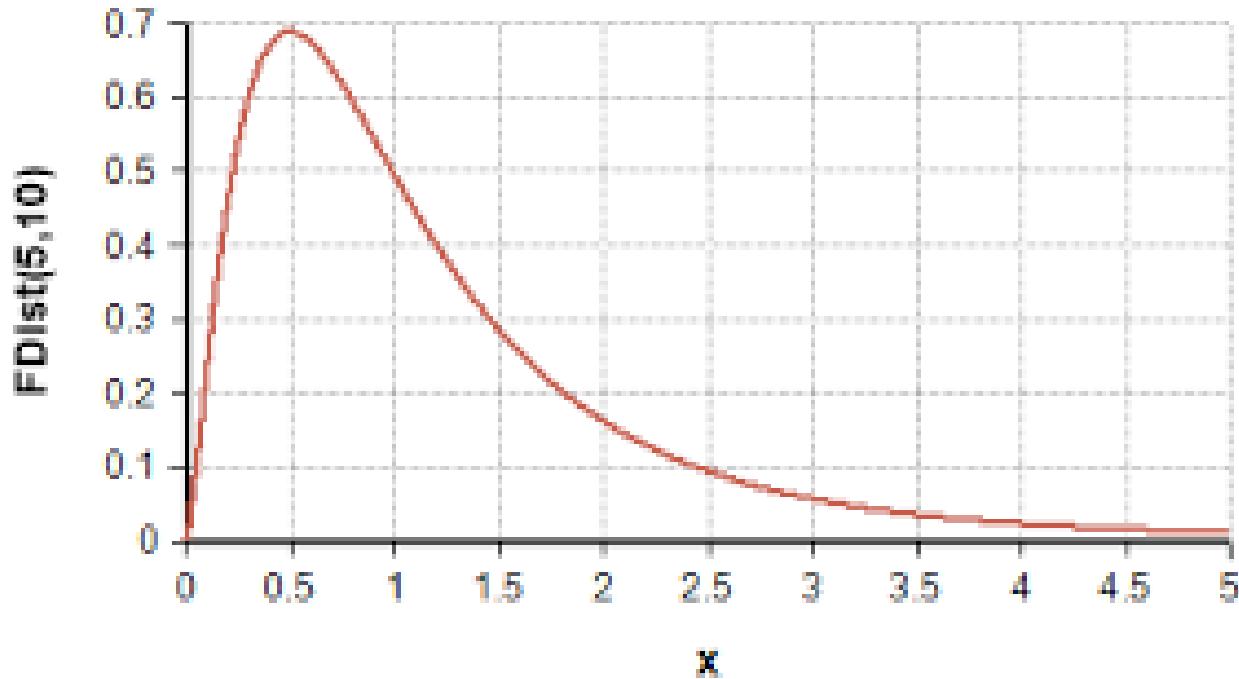


Fig. 25.2: Multivariate Normal Distribution.

Electromagnetic Field (Differential form)

Below, in modern vector notation, in *differential form*, are Maxwell's four equations governing the **electromagnetic field**.

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\epsilon_0} \quad (\text{Gauss's law})$$

$$\nabla \cdot \mathbf{B} = 0 \quad (\text{No magnetic monopoles})$$

$$\nabla \times \mathbf{E} = - \frac{\partial \mathbf{B}}{\partial t} \quad (\text{Faraday-Lenz law})$$

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J} + \mu_0 \epsilon_0 \frac{\partial \mathbf{E}}{\partial t} \quad (\text{Ampere-Maxwell Law})$$

Electromagnetic Field (Integral form)

Below, in modern vector notation, in *integral form*, are Maxwell's four equations governing the electromagnetic field.

$$\oint_{\Sigma} \mathbf{E} \cdot d\mathbf{S} = \frac{Q_{\text{enc}}}{\epsilon_0} \quad (\text{Gauss's law})$$

$$\oint_{\Sigma} \mathbf{B} \cdot d\mathbf{S} = 0 \quad (\text{No magnetic monopoles})$$

$$\oint_{\partial\Sigma} \mathbf{E} \cdot d\mathbf{l} = - \frac{d}{dt} \int_{\Sigma} \mathbf{B} \cdot d\mathbf{S} \quad (\text{Faraday-Lenz law})$$

$$\oint_{\partial\Sigma} \mathbf{B} \cdot d\mathbf{l} = \mu_0 I_{\text{enc}} + \mu_0 \epsilon_0 \frac{d}{dt} \int_{\Sigma} \mathbf{E} \cdot d\mathbf{S} \quad (\text{Ampere-Maxwell Law})$$

Code

Computer programs source code

Python programs

```
"""
O programa traça, em 2D, os perfis instantâneos do
campo elétrico E (y) e do campo magnético B (z),
ambos perpendiculares ao eixo de propagação x.
"""

import numpy as np
import matplotlib.pyplot as plt

# Constantes e parâmetros
c = 3e8
E0 = 1.0
lambda_ = 1.0
k = 2 * np.pi / lambda_
omega = 2 * np.pi * c / lambda_
x = np.linspace(0, 2 * lambda_, 1000)
t = 0
E = E0 * np.sin(k * x - omega * t)
B = (E0 / c) * np.sin(k * x - omega * t)
B_scaled = c * B # para visualização

plt.plot(x, E, label='E(x, t=0)')
plt.plot(x, B_scaled, label='c·B(x, t=0)')
plt.xlabel('x (m)')
plt.ylabel('Amplitude (u.a.)')
plt.title('Propagação de onda eletromagnética no vácuo (instantâneo)')
plt.legend()
plt.grid(True)
plt.show()
```

Fig. 29.1: First program.

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D # registra o proj. 3-D

# ----- parâmetros físicos -----
c = 3.0e8 # velocidade da luz (m s-1)
E0 = 1.0 # amplitude arbitrária do campo elétrico (V m-1)
lam = 1.0 # comprimento de onda (m)
k = 2*np.pi/lam # número de onda
w = 2*np.pi*c/lam # frequência angular
# domínios espacial e temporal
x = np.linspace(0, 2*lam, 1000) # duas ondas completas
t = 0.0 # instante "congelado"
# ----- campos E e B -----
E = E0 * np.sin(k*x - w*t) # componente em y
B = (E0/c) * np.sin(k*x - w*t) # componente em z (antes do escalonamento)
B_plot = c * B # escala-se por c para comparar a E
# ----- figura 3-D -----
fig = plt.figure(figsize=(8, 4))
ax = fig.add_subplot(111, projection='3d')

# linha do campo elétrico: (x, E, 0)
ax.plot(x, E, np.zeros_like(x), label='E(x, t=0)')
# linha do campo magnético escalonado: (x, 0, c B)
ax.plot(x, np.zeros_like(x), B_plot, label='c·B(x, t=0)')
# rótulos e estética
ax.set_xlabel('x (m)')
ax.set_ylabel('E (V/m)')
ax.set_zlabel('c·B (V/m)')
ax.set_title('Propagação de uma onda eletromagnética no vácuo (instantâneo 3-D)')
ax.legend()
plt.tight_layout()
plt.show()
```

Fig. 29.2: Second program.

Electromagnetic wave propagation (1)

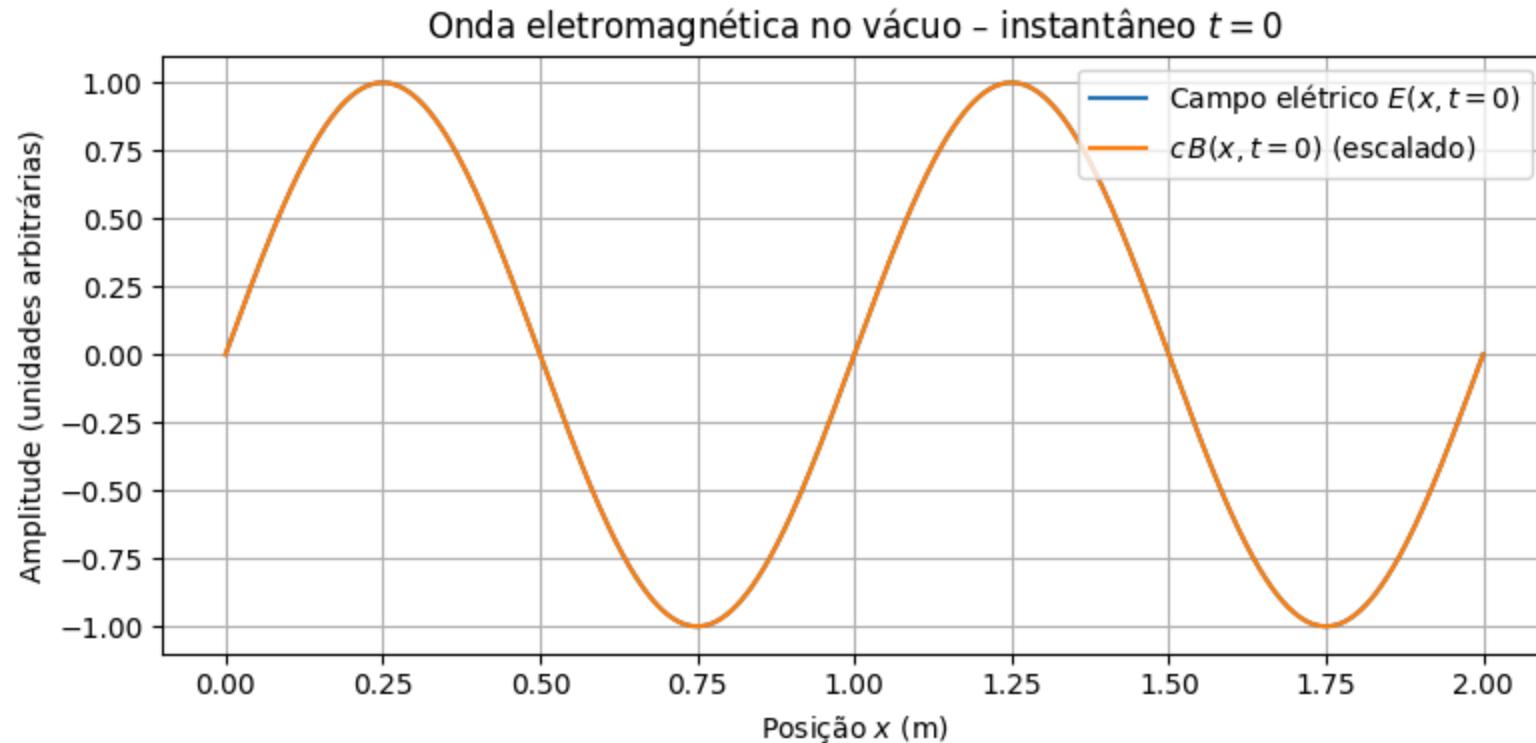


Fig. 30.1: Result of the 3D rendering of the program electromag-plot01.py.

Electromagnetic wave propagation (2)

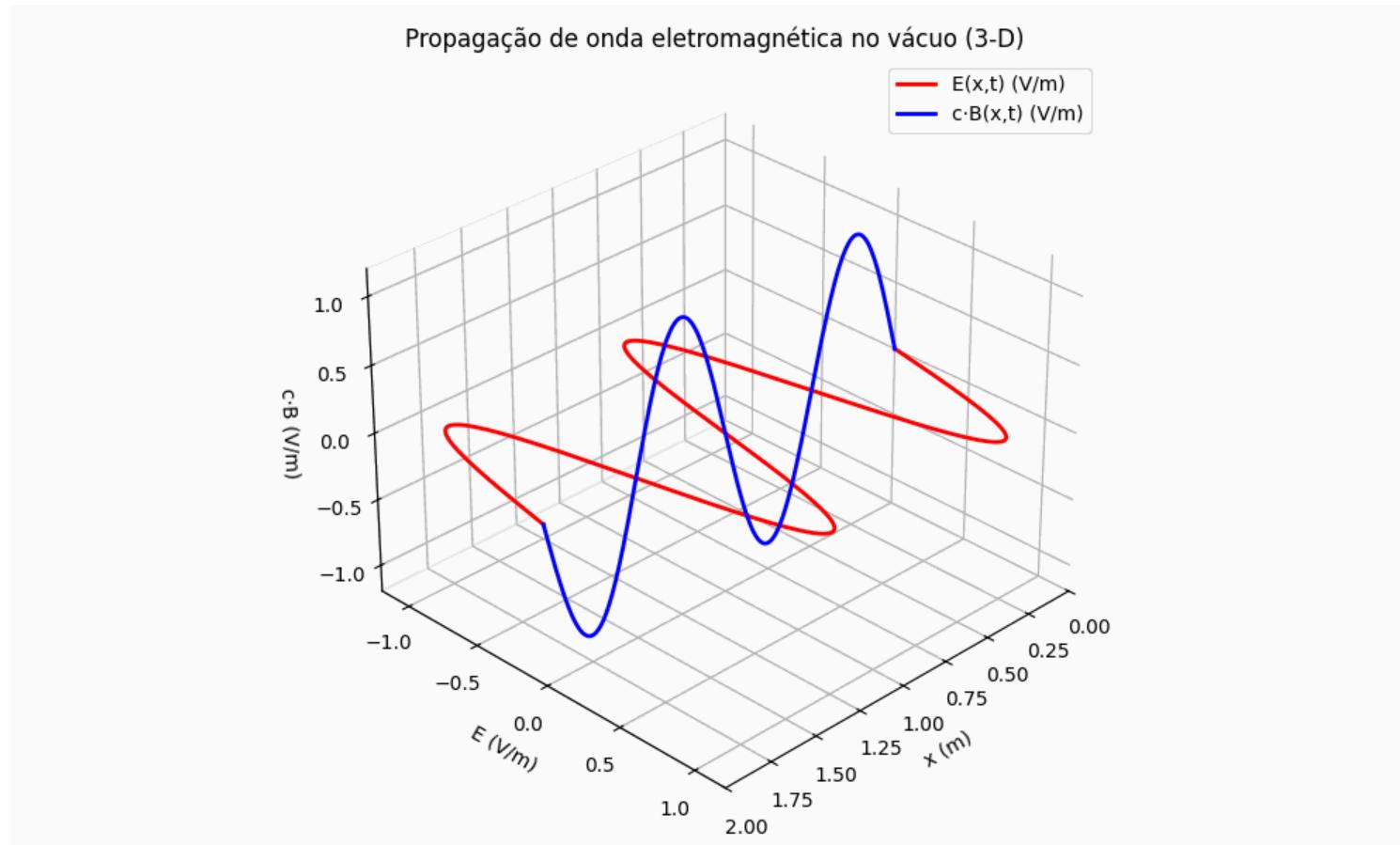


Fig. 31.1: 3D animation of an electromagnetic wave propagation.

Quotes

Special text deserves special space

"There is an *increasing* demand of current information systems to incorporate the use of a higher degree of formalism in the development process. *Formal Methods* consist of a set of tools and techniques based on mathematical model and formal logic that are used to *specify and verify* requirements and designs for hardware and software systems."

"There is an **increasing** demand of current information systems to incorporate the use of a higher degree of formalism in the development process. **Formal Methods** consist of a set of tools and techniques based on mathematical model and formal logic that are used to **specify and verify** requirements and designs for hardware and software systems."

Appendix

Bibliography, References, Appendix. etc.

Appendix 1 - Special Sections (1)

CSS Section	Description/Purpose	Markdown Class (example)
section.title	Title slide	<!-- _class: title -->
section.title-bg	Title slide with background	<!-- _class: title-bg -->
section.chapter	Chapter slide	<!-- _class: chapter -->
section.chapter-alt	Alternative chapter	<!-- _class: chapter-alt -->
section.agenda	Agenda/content slide	<!-- _class: agenda -->
section.end	Thank you slide	<!-- _class: end -->
section.end-bg	Thank you with background	<!-- _class: end-bg -->
section.copyright	Copyright slide	<!-- _class: copyright -->
section.logos	Slide with additional logos	<!-- _class: logos -->

Tab. 36.1: List of tags used (1).

Appendix 1 - Special Sections (2)

CSS Section	Description/Purpose	Markdown Class (example)
section.blank	Blank slide	<!-- _class: blank -->
section.nobrand	Slide without branding	<!-- _class: nobrand -->
section.multicolumn	Slide with multiple columns	<!-- _class: multicolumn -->
section.multicolumn vcenter	Vertically centered IN multiple columns	<!-- _class: multicolumn vcenter -->
section.grid-tlr	Grid: top, left, right	<!-- _class: grid-tlr -->
section.grid-lrb	Grid: left, right, bottom	<!-- _class: grid-lrb -->
section.quote	Quote slide (unified quote)	<!-- _class: quote -->
section.quote.dark	Alternative quote (formerly quote2)	<!-- _class: quote dark -->
section.references	References/bibliography slide	<!-- _class: references -->

Tab. 37.1: List of tags used (2).

References

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Credits

1. Special thanks to: [Yuki Hattori](#) creator of [Marp](#).
2. Early inspiring ideas: [Juan Vera del Campo](#) [CSS styles](#). Gracias!
3. Inspired by the work of [Daniel Kriesten](#) at [marp-template-hsmw](#). Herzlichen Dank!
4. Biography on Wikipedia: [Jacques-Louis David](#).
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10. Foto de Wikipedia: [Léonidas aux Thermopyles](#).
11. Foto de Wikipedia: [Sócates](#)
12. Foto de: [Pixabay](#) [no Pexels](#).
13. Font [Fira Sans](#) imported from: [Google Fonts](#).

Let there be celebration!
MarpX is here!





**Click to the
Beginning**