

Optimale Steuerung und theoretische Analyse eines mathematischen zwei Serotypen Dengue-Fieber Modells

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Abstract. Dengue Fieber ist eine Krankheit, die durch die Infektion mit dem Denge-Virus hervorgerufen wird. Dieser Virus wird durch den Stich einer infizierten Asiatischen Tigermücke übertragen. Die sehr robuste und anpassungsfähige Stechmückenart ist ursprünglich aus Südostasien, jedoch ist durch Warentransporte und Tourismus eine zunehmende (Wieder-)Besiedlung in Europa zu beobachten. In dem Jahre 2017 sind erste stabile Populationen in Süddeutschland detektiert worden. Mit der Ausbreitung der Asiatischen Tigermücke ist auch eine zunehmende Gefahr des Dengue Fiebers einhergehend. WHO schätzt die jährliche Infektionsrate auf ca. 390 Millionen Infektionen Weltweit. Der Dengue Virus existiert mit 4 verschiedenen Serotypen. Jeder Serotyp löst das Dengue Fieber aus. Bei einer Zweitinfektion kann ein hämorrhagische Dengue Fieber bis hin zu einem Dengue Schock Syndrom auftreten. Aufgrund dessen wird in diesem Paper ein Zwei Serotypen Modell betrachtet, charakteristischen Größen berechnet und numerischen Ergebnissen diskutiert. Erstmals wird eine temporäre Immunität bei der Zweitinfektion berücksichtigt und zusätzlich europäische Mückenparameter in den numerischen Simulation und der optimalen Steuerung benutzt.

Introduction

The first section of your paper should be titled 'Introduction' (or similar). It does not bear any section number and should not have any subsections. If you want to change the title of this section, just replace 'Introduction' in `\section*{Introduction}` with your desired title.

Do not modify the page geometry or page margins. Just insert your plain text and structure it by

using the commands `\section{Section One}`, `\subsection{Subsection One}` and `\paragrph{Paragraph One}`.

1 Text / Section

All papers must be written in English. Make good use of the spellchecker. If you want to add an hyphenation-exception, just add the line `\hyphenation{DoNotHyphenateThisWord}` into the 'paper-specific data'-section right before `\begin{document}`.

All sections but the introduction and the appendix are numbered. You may also use subsections. Note that no more than two levels are allowed – if you need another level, please use paragraph headings as follows:

Paragraph heading. This is an example of a paragraph heading. Note that the heading is followed by a dot.

2 Formulas

Since this is \LaTeX , you have a very powerful tool at hand for inserting formulas. For numbered formulas use the `equation`-environment. Add a label via `\label{eqn:myFirstEq}` immediately after `\begin{equation}` if you want to reference your equation later somewhere in your text.

$$\nabla^2 \phi = -4\pi \tag{1}$$

To reference a labeled equation, simply type `(\ref{eqn:myFirstEq})`. For example look at equation (1). If you want to type a whole bunch of equations at once use the `eqnarray`-

environment via typing `\begin{eqnarray}`.

$$\begin{aligned} \frac{dy}{dt}(t) &= \begin{cases} -g \cdot t + v_0 & \text{for } y > 0 \\ 0 & \text{otherwise} \end{cases} \\ y(0) &= y_0 \end{aligned} \quad (2)$$

In an equation-array you can place a label right before every single equation-line. Equation (2) shows the initial value. Type `\nonumber` after every equation in your equation-array, which you don't want to have a number on its own. To place unnumbered equations, respectively equation-arrays, use the `equation*` respectively `eqnarray*` environment instead. For example

$$x_{n+1} = x_n + x_{n-1}$$

Inline formulas and mathematical symbols like ϕ are to be placed between two $\$$ -symbols. E.g. `\phi \in C^\infty` is translated into $\phi \in C^\infty$.

3 Figures

For figures use the `figure`-environment and compose a comprehensive caption for each figure. Make sure that the text inside the figure is also in English or else provide a translation.

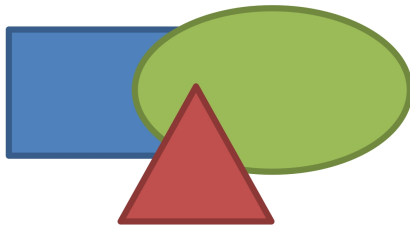


Figure 1: Each figure and table caption is put below the figure and typeset like this caption. Compose good, comprehensive captions.

The same way you label your equations, you can label your figures as well. Figure 1 shows a sample-figure. Do not wonder, if your figure is not exactly where you placed it, for latex automatically shifts the figure to the next column respectively page, if there isn't enough space left in the current column resp. on the current page. But to fill the resulting empty space, it is continued with the figure following text. Therefore, more

than ever it's important to label your figures and reference them.

It's not recommended, but if you can't help placing a figure spanning over the whole two columns, use the `figure*` environment instead and encapsulate the `\includegraphics`-command in a `\mbox`-command. Such figures though, are not placed until the next page. As demonstrated with the help of Figure 2.

3.1 Subsections

Figures must be provided with sufficient resolution (picture files), or adequately scalable (vector graphics).

4 Lists and Tables

For lists and numbered lists use the `itemize` resp. `enumerate` environment.

- Template SNE Itemized List -1
 - Template SNE Itemized List -2
1. Template SNE Numbered List -1
 2. Template SNE Numbered List -1

Tables need not follow a given template; we suggest a plain formatting with row and column headers (if necessary) in bold as

	Row Header	RH
Col1	SNE Table Cell Format – I1	Item 2
Col2	Item3	Item 4

Table 1: Each figure and table caption is put below the figure and typeset like this caption. Compose good, comprehensive captions.

5 Listings and Code

Code snippets of computer programs can be put in running text or in sections using the `verbatim`-environment:

```
Begin {
  Printf ('hello world')
  Exit}
```

As long listings may impair the readability of the running text, it is suggested to make use of an unnumbered *Appendix Section* at the end of the article.

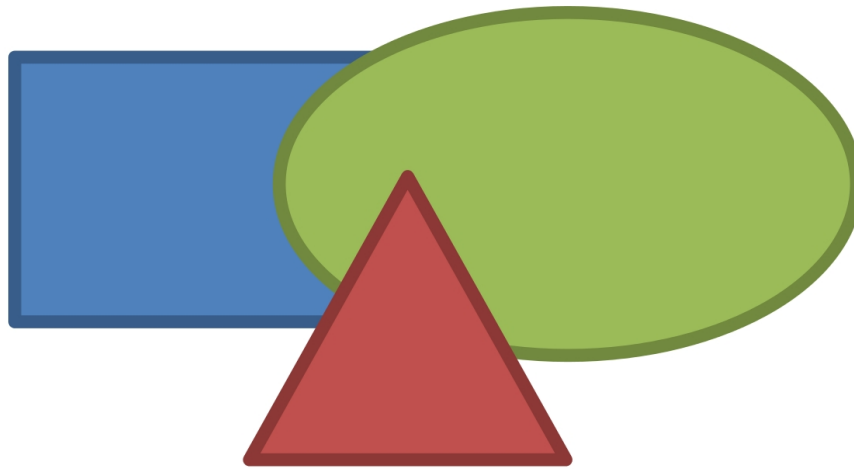


Figure 2: A two-column spanning figure.

Acknowledgement

Acknowledgements come here.

Appendix

If there is the need for an appendix, this is the right place for it. Again use an unnumbered section for this purpose, as already used for the introduction.

References

- [1] Author, A. *Title of his published book*. Edition. City of Publisher: Abbrev. of Publisher; year. total pages of book p.
- [2] Author2 A, Author3 BC, Author4 D, editors. *Title of published book*. 8th ed. City of Publisher: Abbrev. of Publisher; year. 1234 p.
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