Activity 11

Writing a scientific article

Goals

The different results found during the previous activities must be synthesised, enlightened, interpreted and used in an application; and presented in a scientific article.

The content of a scientific article

A scientific article is not a collection of unrelated results. It must have a goal (a fundamental axis, a point to reach). This goal must be in relation to the chosen physical (or more generally scientific) application of your dynamical system. The different results and plots obtained during the previous activities must be sorted. The ones which are important for the goal of the paper, must appear in the main text, must be extensively commented, must be interpreted in the context of the application and it is necessary to show what they bring to the goal pursued in the paper. The results of less importance, must be relegated in appendices with only few comments, and can be not integrated to a reasoning. The order of use of the results in the paper must be consistent with the pursued goal and form a logical reasoning. If some important computations needed for the reasoning have not be realised during the previous activities, they must be realised now.

The goal of the paper can be one of the following:

- Solve, illustrate or enlighten a fundamental scientific question/phenomenon, or an industrial, software or societal problem.
- Discuss an epistemological question (concerning the scientific procedure or the history of sciences), a philosophic question (concerning the interpretation of a scientific theory, or the conception of the Reality and of the Nature), or an artistic approach (use of dynamical systems in aesthetic goal).
- Compare models to experimental or observational results (in that case, the student is responsible for finding the data or to realise the experiments or observations).
- Study the foundations of the dynamical system itself; in that case the paper must include a detailed numerical analysis of this one (algorithmic foundations, study of the better manner to simulate the system, study of the quality and the speed of convergence) and it must include a mathematical analysis (with rigorous proves, detailed calculations and formal definitions) of its properties.

Things necessarily appearing in an article

All results found during the activities must appear. The equations/model and the parameters used to obtain a result or a plot must explicitly be written in order to all presented result be reproducible (in

general the parameters needed to compute a plot or results in a table, are written in the caption of this one). The algorithms used to obtain the numerical results must be cited by their names if these ones are standard methods (it is not necessary to write the equations or the pseudo-code of a standard method). If a new algorithm has been developed to obtain the results, or if substantial modifications of a standard algorithm have been realised to adapt this one to a special situation, the equations and/or the pseudo-code must be written in the paper (eventually in appendix). The source codes do not appear in a scientific paper.

The sources of the data used or collected for the paper must be cited. If the quantity of these data is reasonable and if they are open source, they can appear explicitly in the paper (eventually in appendix). If the quantity of data are too large but if they are open source, they must be available in a computer server (a public database). If the data belong to closed source, the complete references of this one must be cited.

The complete references of the bibliography used to produce the paper must be written. The quoted sentences must be emphased (by italic fonts) and the number of the reference must appear immediately after the quotation. The number of the reference must also appear at the beginning or at the end of a rephrased paragraph. A result, an equation, a plot or a table coming from another work must be followed by the number of the source reference (in the caption for a plot or a table). The only exception is for equations or models "universally" known (we can write the Maxwell equations without citing explicitly the paper of James Clerk Maxwell).

Formatting an article

The article must written in English by using LaTeX (with the *article* class). The usual size of a paper is between 4 and 25 pages without counting appendices (longer articles are possible if it is justified by a long mathematical demonstration or by a large number of figures, but it needs to well choose the pertinent informations appearing in the main text).

A scientific paper is organised as follows:

- A title followed by the names of the authors (in order of importance of their contribution) and their professional contacts (laboratory or department - with its postal address -, university)[1] and the email address of the contact author.
- An abstract summarising the results which can be found in the paper and presenting the goal of this one.
- An introduction presenting in detail the goal and replacing this one in a general scientific context, presenting the state of art concerning the treated question (including the more important references used in the paper), and announcing the plan of the article.
- The main text is structured by sections and subsections, which have titles. The equations, the figures and the tables must all be numbered. They are cited in the text by these numbers.
- A conclusion presenting the synthesis of the shown results, developing the final discussion/conclusion about the pursued goal, discussing the pertinence and the validity of the presented results and suggesting ways to improve them, and enlarging the discussion by suggesting future works, other applications or the use of the results in larger scientific context.

[1] For master students, the correct contact is "*Master CompuPhys (EIPHI Graduate School, Observatoire de Besançon, Université de Bourgogne-Franche-Comté), 41bis Avenue de l'Observatoire, BP1615, 25010 Besançon cedex, France*

- A bibliography where the items are numbered: the citation of an article must include the author names, the journal references (name of the journal, volume number, page or article number), the year of publication; the citation of a book must include the author names, the book title, the edition references (editor name, city of the print, year of the first publication); the citation of a preprint must include the author names, the name of preprint archive and the number of the preprint.

Work to be done

Write a scientific article about your dynamical system presenting the results obtained during the previous activities.