

Introduction

The Course

The aim of this [course](#) is to teach new users how to numerically model gravitational wave laser interferometry by using *Finesse* and its Python wrapper *PyKat*, as well as functioning as reference material for advanced users. All needed course material is free and available to download online. The course is based on hands-on work in IPython Notebooks, in which we point the users to recommended reading material for each notebook session.

When completed, this course will be able to bring beginners in both laser interferometry and FINESSE/PyKat into being capable to perform modelling of advanced gravitational wave laser interferometry. However, as this course is in an early life stage, it does not yet provide that full coverage, but still constitutes a good starting point for learning FINESSE and laser interferometry modelling in the frequency domain.

Before you start modelling:

If you have not previously used FINESSE and PyKat in an *Ipython3 notebook*, please read the “Simulation preparation” document located in this folder.

FINESSE

FINESSE is a Frequency domain INterfERometer Simulation SoftwarE, designed for modelling gravitational wave laser interferometry, but can successfully be used for modelling other laser experiments as well.



FINESSE is a free and open source project, released under the GPL3 licence. We are thankful if you help us with feedback and suggestions, by submitting example file or even by contributing directly to the code development. To facilitate this we have setup a Redmine project site for Finesse, where you find the Finesse source code and information on how to get involved in case you would like to.

The FINESSE project began at GEO 600 as an effort to create a fast and easy to use interferometer simulation software that can be used to design and debug laser interferometers, simulate many different user-defined optical setups, as well as playfully teach and learn more about laser optics.

FINESSE has a long pedigree and has benefited from years of real-life employment by the optics groups of gravitational wave detectors. While some of the code is ten years old we are committed to adapting the code to new challenges posed by new types of interferometry in future projects, maintaining the code and the trust which has been built through years of testing against experimental results.

PyKat

PyKat is a free and open source Python interface and set of tools to run Finesse. It aims to provide a Python toolset for automating more complex tasks as well as providing a GUI for manipulating and viewing simulation setups. However, it also provides tools for performing free standing optical computations.



PyKat has been used for commissioning of gravitational wave detectors, where much of the FINESSE simulations are automated by PyKat.

Contributions and suggestions to the Python code are very welcome!

IPython Notebook

IPython Notebook is an interactive environment, in which you can combine code execution, text, mathematics, and images. It provides a platform that facilitates transparent and reproducible research as input data; code; analytical expression; explaining text and figures; computations; and results such as output data and figures, can be gathered and performed in the same notebook document. Because of this we believe that we and other researchers will use IPython notebook more and more frequently to present scientific results.

For the same reasons IPython Notebook also provides an excellent platform for teaching and learning numerical modelling, which we utilise in this course.

Do not hesitate to contact us if you have any problems, questions or suggestions.

We hope you will have fun,

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