Master thesis / semester project at EPFL

Gas Bearing simulation code: GUI, numerical enhancement in Julia and model generalization.

General information

- Laboratory: Laboratory for Applied Mechanical Design (LAMD), EPFL
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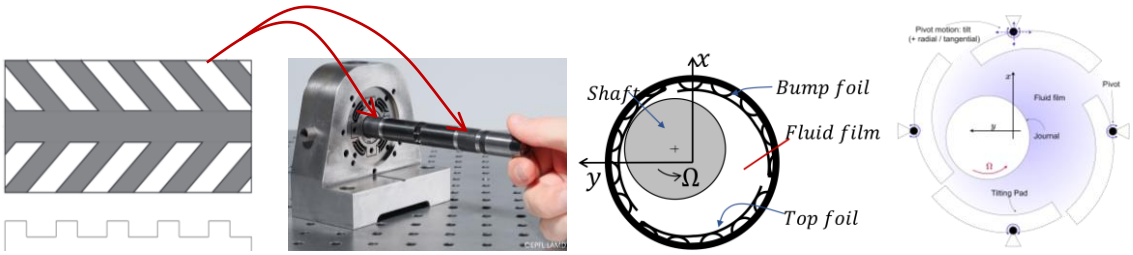
Background and objectives

The accurate and reliable numerical modeling of gas-lubricated bearings is essential for their design in order to predict their performance and assess stability. Many different bearing architectures are possible, three of which are the main ones and are the one being treated by the laboratory, namely: herringbone grooved journal bearings (HGJB), gas foil bearings (GFB) and tilting pad bearings (TPB). These are represented schematically in the image below.



LAMD possesses numerical models, in the form of MATLAB codes, for each of these bearing types. These codes are independent, which leads to divergence in implementation styles. Also, these codes are run without a unique graphical interface that allows to run different numerical experiments with ease, swapping out bearings and modifying experimental conditions with just a few clicks.

Objectives:

1. Define the requirements for the graphical user interface(s), in terms of views, desired functionalities and API. This entails interfacing with the laboratory to define a set of requirements and desired functionalities. Plan the code out in a way that it is modular and allows for future expansions.
2. Develop a GUI that allows to launch numerical experiments by setting the parameters with ease. This can take any form, from a Matalb interactive figure to a locally-hosted web interface. This entail also exploring the best frameworks and programming languages in

which to develop this GUI, taking into consideration the tradeoff between flexibily, ease of implementation and future expandability.
3. Re-structure the bearing codes into a unified one by making it modular, with easily mantainable and common interfaces between the various modules. Python is preferred.
4. Porting of the computationally heavy parts of the code into a framework that is optimized to scientific calculations like native Julia language, python (via the usage of numpy) or C++, along with numerical optimization.

Note: depending on the amount of credits/hours (semester project of master theisis), this could be concretized into an outline/code plan, a partial product (e.g. the refactoring of only one out of 3 bearing types, or just the GUI for one/two types of bearings), or a fully delivered product.

Recommended prerequisites

- Skills and passion for programming in general.
- Agility with programming languages outside MATLAB (Python preferred).
- Previous projects, especially if related to web or mobile application development.