This PhD aims at developing novel computational tools to help casual users to design hand-operated marionettes so that they can be used for broader applications. Indeed, as physical embodiments of imaginary characters, marionettes could be exploited to facilitate the exploration of alternate choreographies by artists, for social experiments [4], as tangible interfaces [3], for educational purposes or simply for casual entertainment. This goal brings new challenges related to the parameters and explored, in particular, the design of robotic actuation systems [1] and control policies [6]. While Murphy and Egerstedt tackled the problem of automation of marionettes plays [4], they assumed the marionettes strings locations and lengths to be known, whereas we are concerned with the design of the full system, which makes the problem more difficult, but also more interesting.

References

Assignments:
The goal of this PhD is to develop novel computational tools to help casual users and artists to design marionettes manually operated by strings. In particular, we will investigate algorithms to efficiently simulate the movements of the marionettes and to automatically optimize the marionettes' design parameters (e.g. lengths of the strings, attachment points) such that the marionettes can be used to replicate target animations or to be able to reach static target poses. To this end, one possibility will be to adapt and extend the formulation that we developed for the design of actuated deformable characters.
of actuated deformable characters, based on a constrained minimization problem that encourages sparsity of the actuation points [5]. Along the way, this PhD will try to address several open research questions. Since marionettes are under-actuated, several solutions for the strings locations and lengths can lead to the same pose. Can we leverage this redundancy and optimize these parameters such that users can easily compose the results obtained for canonical movements into a single animation? What’s the best way to represent the target motions? From a broader point of view, this PhD will be the opportunity to work on the co-optimization of design and actuation parameters of dynamic systems as well as on the representation of complex target motions from, for example, simpler building blocks.

Principal activities
Research, design and implementation of algorithms for the direct simulation and inverse modeling of marionettes.
- Design and implementation of graphical user interfaces for interacting with the above algorithms.
- Evaluation of the developed methods
* Additional activities:
- Writing of research papers
- Presentation of research work in conferences, seminars

Competences
The candidate should be fluent in English and hold a Master’s degree (or be about to earn one) or have a university degree equivalent to a European Master’s (5-year duration). He/she should be proficient with C++, have a strong background in computer science and applied maths, and ideally some experience with computational fabrication or computer graphics.

Avantages sociaux
- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Rémunération
Monthly salary after taxes: around 1596,05€ for 1st and 2nd year. 1678,99€ for 3rd year (medical insurance included).