



INTERNSHIP PROGRAM FOR INTERNATIONAL STUDENTS

INTERNSHIP SUBJECT FORM

Name of the Host Laboratory	LadHyX
Website of the Host Laboratory	https://www.ladhyx.polytechnique.fr/fr/
Research Group	LadHyX
Internship Supervisor	Sophie Ramanananarivo
Internship Subject	Origami: Designing the elastic response of an object in a fluid
Student's level	<input type="checkbox"/> Advanced Undergraduate Students (3 rd or 4 th year) <input checked="" type="checkbox"/> Master's students (1 st or 2 nd year) <input type="checkbox"/> PhD students
Proposed Duration	<input type="checkbox"/> 3 months <input checked="" type="checkbox"/> 4 months <input checked="" type="checkbox"/> 5 months <input checked="" type="checkbox"/> 6 months
Prerequisites	fluid mechanics, continuum mechanics and/or fluid/structure interaction
Internship description (max. 15 lines)	<p>Origami is the science of sheets folded along creases. The geometry of the folds conditions the way the structure deforms, allowing only for certain motion while being rigid to other modes of deformation. Such foldable structures are commonly used in nature, for example in the opening of buds or the deployment of insect wings. Folding patterns impart a form of feedback and intelligence to the object, enabling a mechanical coupling between an opening and extension motion for example. The resulting mechanical properties are likely to improve the wind resistance of plants, or to optimize flight performances of an insect by allowing for the wings to modify their shape in the ascending and descending phase of the flapping motion. In this internship, we will study those biomechanical mechanisms on model geometries of origami in controlled flows, with potential applications in biomimetic engineering. Origami with faces of varying flexibility and deformable folds will be constructed from elastomer or polymer sheets through laser cutting techniques. Their mechanical response in a controlled flow will be characterized experimentally, and further modeled theoretically. Practical applications can also be implemented, such as for propulsion based on drag (like the paddling of a duck), that alternates strokes that push fluid and restoring stroke where drag has to be reduced.</p>