## Internship Program for International Students

### Internship Subject Form

<table>
<thead>
<tr>
<th>Name of the Host Laboratory</th>
<th>LadHyX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website of the Host Laboratory</td>
<td><a href="https://www.ladhyx.polytechnique.fr/fr/">https://www.ladhyx.polytechnique.fr/fr/</a></td>
</tr>
<tr>
<td>Research Group</td>
<td>LadHyX</td>
</tr>
<tr>
<td>Internship Supervisor</td>
<td>Sophie Ramananarivo</td>
</tr>
<tr>
<td>Internship Subject</td>
<td>Origami: Designing the elastic response of an object in a fluid</td>
</tr>
</tbody>
</table>

**Student's level**
- [ ] Advanced Undergraduate Students (3rd or 4th year)
- [x] Master’s students (1st or 2nd year)
- [ ] PhD students

**Proposed Duration**
- [ ] 3 months
- [ ] 4 months
- [x] 5 months
- [x] 6 months

**Prerequisites**
- fluid mechanics, continuum mechanics and/or fluid/structure interaction

**Internship description (max. 15 lines)**

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.