GENERAL INFORMATION
Program sponsor: Princeton Environmental Institute
Position number: U1ADR1
Project title: Noise Pollution and Barriers
Organization/research group: Form Finding Lab
Primary location(s) of internship: Princeton University
Additional cities and/or countries to be visited (if applicable): n/a

Note: If this internship is located in a country with an International SOS risk rating of High or Extreme, final candidates must participate in a travel review process overseen by the Travel Oversight Group (TOG), and obtain safety guidance prior to departure. The University reserves the right to revoke support and funding for travel at any time there has been a significant deterioration in the safety and security conditions surrounding travel arrangements, or in the sector of the country, or countries, where travel is to occur.

FACULTY SPONSOR(s)/HOST INFORMATION
Name(s): Sigrid Adriaenssens
University Department(s): Civil and Environmental Engineering
E-mail: sadriaen@princeton.edu
Website: http://formfindinglab.princeton.edu/

INTERNERSHIP/RESEARCH PROJECT INFORMATION
Internship/project description:
Noise pollution is a growing problem that affects our health. Despite noise codes being reinforced through laws, a complaint is filed every four minutes in cities like New York. Managing noise is difficult as sources such as automobiles produce a wide range of sound frequencies that vary over time. In this project, we propose the development of origami noise barriers that can adapt their shape as a function of the noise frequency that needs to be blocked or absorbed. Origami, the 17th century Japanese art form of paper folding, has stirred research interest into foldability of developable surfaces. Most research has focused on straight crease origami. In this project however, we focus on the lesser-explored curved crease origami, which has fewer creases and generally only needs actuation along one degree of freedom only. From a manufacturing and actuation perspective, these are great advantages. The curved crease origami-inspired noise barriers we propose can adapt their shape to block specific noise frequency ranges. Because the noise frequency of traffic, for example, depends on the speed of traffic, we propose a system that takes advantage of this adaptive stopband characteristic.

Student’s role and responsibilities:
The work involves the identification of existing curved crease origami patterns. These patterns will form the basis for their CAD modeling of these patterns using parametric modeling software Rhinoceros. The student will parametrically model these patterns in Grasshopper, test and optimize them (Pachyderm) and use digital laser cutting technique to fabricate prototypes which will be tested for acoustic performance and deployability. The prototypes will further be enhanced with reflective and absorbent surfaces. The student will design experiments and carry out small scale experiments to evaluate the effectiveness of the patterns.
**Internship/project learning objectives:**
- understand the basics of acoustic wave propagation,
- develop digital parametric models,
- perform acoustic simulations in a parametric design environment,
- produce fabrication layouts for the models,
- design and prototypes small scale models, using digital fabrication techniques,
- develop and test an acoustic experiment,

**PROGRAM REQUIREMENTS**

**Academic background and any course pre-requisites:**
architecture, mechanical or civil engineering major
having taken ARC374 would be a bonus

**Technical skills:**
none

**Additional training(s):**
none

**Equipment:**
student must bring laptop

**Physical demands:**
none

**Language abilities/competencies:** n/a

**Additional information about the internship/project:**
Participating student will need to complete lab safety training prior to that start of the internship.

**INTERNATIONAL TRAVEL REQUIREMENTS (if applicable)**

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<th>Visa(s) required?</th>
<th>Research permit/pass required?</th>
<th>Immunizations required?</th>
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<tbody>
<tr>
<td>Yes</td>
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<td>No</td>
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**INTERNERSHIP/PROJECT SUPERVISOR(S)**

**Name and title of primary supervisor:** Sigrid Adriaenssens

**Email:** sadriaen@princeton.edu  **Phone:** 609 258 4661

**Name and title of additional supervisor, if applicable:** N/A

**E-mail:**  **Phone:**

**PROGRAM DATES AND FUNDING INFORMATION**

<table>
<thead>
<tr>
<th>Weekly Stipend: $500</th>
<th>Number of Positions Available: 1</th>
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<tbody>
<tr>
<td>Tentative Start Date (mm/dd/yyyy): 05/27/2018</td>
<td>Number of Weeks: 8</td>
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<tr>
<td>Tentative End Date (mm/dd/yyyy): 07/19/2018</td>
<td><strong>Note:</strong> PEI funding is for full-time work, 35 hours per week minimum, and for a period of at least 8 continuous weeks.</td>
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**Application Deadline:** January 11, 2019