# Can We Tailor the Behavior of Flexible Sheets in Flows by Adding Cuts or Folds?

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## MAE Seminar Series

**Lightweight compliant surfaces are commonly used as roofs (awnings), filtration systems or propulsive appendages, that operate in a fluid environment. Their flexibility allows for shape to change in fluid flows, to better endure harsh or fluctuating conditions, or enhance flight performance of insect wings for example. The way the structure deforms is however key to fulfill its function, prompting the need for control levers. In this talk, we will consider two ways to tailor the deformation of surfaces in a flow, making use of the properties of origami (folded sheet) and kirigami (sheet with a network of cuts). Previous literature showed that the substructure of folds or cuts allows for sophisticated shape morphing, and produces tunable mechanical properties. We will discuss how those original features impact the way the structure interacts with a flow, through combined experiments and theory. We will notably show that a sheet with a symmetric cutting pattern can produce an asymmetric deformation, and study the underlying fluid-structure couplings to further program shape morphing through the cuts arrangement. We will also show that extreme shape reconfiguration through origami folding can cap fluid drag.**

**Sophie Ramananarivo graduated from Ecole Normale Supérieure in Physics (2010) and received her Ph.D. in fluid-structure interaction from ESPCI in Paris (2014). After a year as a post-doctoral associate at the AML laboratory at the Courant Institute of NYU, she spent two years in the Physics Department of UC San Diego before joining Ecole Polytechnique Paris as an Assistant Professor in the Mechanics Department in 2017. Her research focuses on the interactions between fluids and solid objects that can move or deform. Her past work addressed questions relative to animal flight and swimming, such as the role of flows in the formation of fish schools and bird flocks. She also investigated different forms of coupling at the microscopic scale, studying the interactions between microscopic swimmers and their colloidal environment. Currently, she is examining the interaction of highly flexible structures with fluid flow and exploring ways to control their response through their design.**

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