Origami Paper Parachutes in HADR Operations

Yam, Natalie (School: Anglo-Chinese School (Independent))

In Humanitarian Aid and Disaster Relief (HADR) operations, a swift response is crucial to cut costs and minimize casualties. Origami paper parachutes present a novel solution to delivering relief supplies to affected areas as they can be self-deployed from Unmanned Aerial Vehicles. This speeds up delivery by eliminating the need to clear debris and construct landing sites for delivery aircraft, and allows more effort to be directed towards evacuating civilians instead of transporting supplies. Paper is a suitable material for this one-time no-recovery use scenario as it is low-cost and biodegradable. Origami folds create a dependable deployment mechanism and allows the parachute to be kept compactly. Indoor experiments were conducted to optimise the design parameters of the origami parachute. The most promising design comprising of a waterbomb tessellation folded canopy was chosen to be scaled to a larger size as it exhibited the smoothest opening behavior and a relatively long aloft time with minimal compromise to stability. The chosen origami design and a baseline non-foldable parachute were tested at full scale by releasing them outdoors from a greater height, using an Inertial Measurement Unit—which recorded the quaternions and raw acceleration of the parachute—as a payload. The data was processed using Octave software to obtain plots of the acceleration, velocity, trajectory, and oscillatory behavior of the parachute, which were analyzed to evaluate its stability and drag. Owing to the higher canopy porosity and the residual folds, the origami design had less drag but more stability than the baseline design. In this project, a self-deploying origami paper parachute was created and tested for promising enhancement of HADR operations.

Awards Won:
Fourth Award of $500