Biomimetic Flapping Wing Using Smart Materials

**Smart Flapping Wing**
- Flapping flight effected by effective AOA, vertical component of thrust, camber effect
- Development of smart flapping wing using MFC actuator to change the camber
- Measurement of dynamic performance for several flight conditions from wind tunnel tests
- Lift: mostly affected by flow velocity and angle of attack
- Thrust: mostly affected by flow velocity and flapping frequency
- Performance improvement of mean lift (20.8%) and mean thrust (4.6%) by camber effect using surface actuator
- Unsteady effect of dynamic vortex in low advance ratio region

\[ J = \frac{\text{forward velocity}(V)}{\text{wing tip velocity normal to flapping axis}(2\delta \phi)} \]

Unsteady effect of dynamic vortex

Flapping motion of smart flapping wing measured by Hi-speed

Low speed wind tunnel test

Mean lift and thrust values