



Advanced
Grant

Bio-inspired End-Effectors Development and Applications Progress

Alejandro E. Gomez Tamm
Vicente Pérez Sánchez
Begoña C. Arrue
Aníbal Ollero



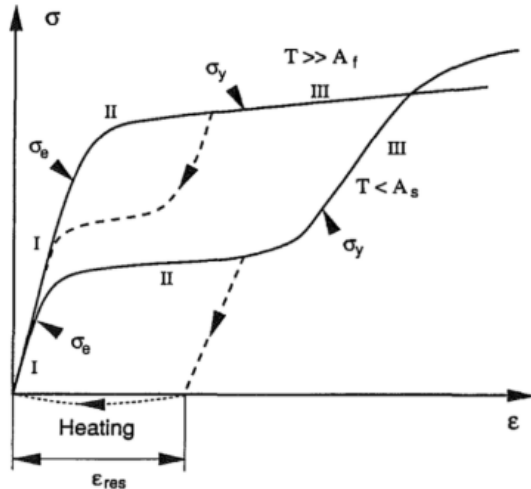
Index



Advanced
Grant

- Model identification (SMA): Experiments & Theoretical Validation
- Claw Design
- Integration
- Real Experiments
- Conclusions
- Working on

SMA Characterization



$$\sigma - \sigma_0 = D(\epsilon - \epsilon_0) + \Omega(\xi - \xi_0) + \theta(T - T_0)$$

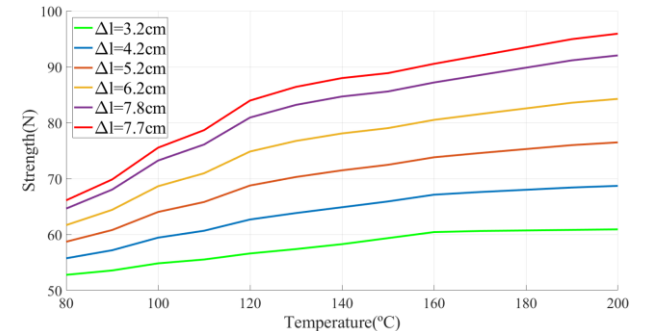
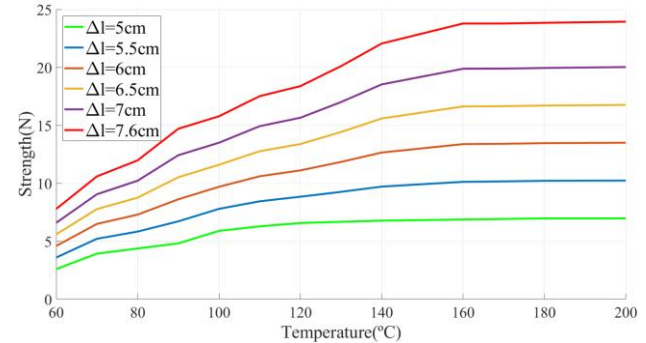
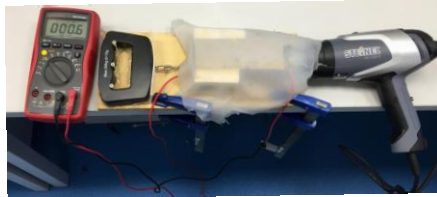
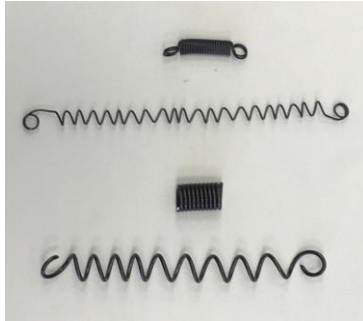
$$\dot{\sigma} = D\dot{\epsilon} + \Omega\dot{\xi} + \theta\dot{T}$$

Liang, C., Rogers, C.A. Design of shape memory alloy springs with applications in vibration control. Journal of Vibration and Acoustics. Vol: 115, 129-135. 1993.



In collaboration with

Electrical and Mechanical Identification



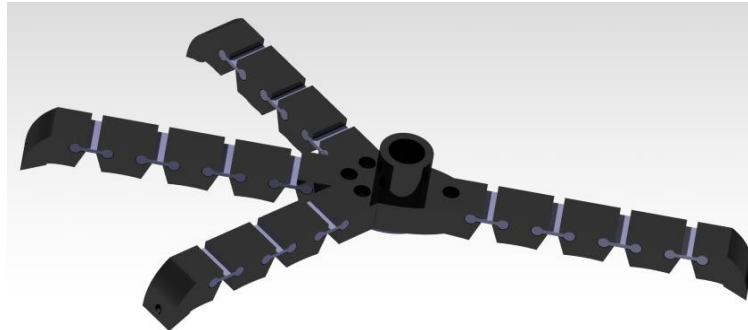
$$\delta_{effective} = \delta_M + \delta_L - \delta_H$$

$$\delta = \frac{8FD^3n}{Gd^4}$$

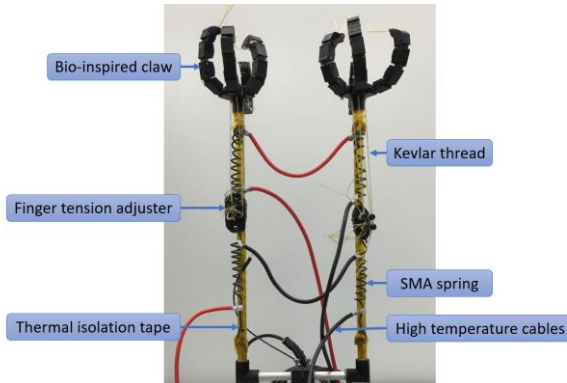
$$\delta_M = \frac{\pi\gamma D^2n}{d\kappa}$$

Sangbae Kim, Elliot Hawkes, Kyujin Choy, Matthew Joldaz, JoeFoley, and Robert Wood. Micro artificial muscle fiber using nitispring for soft robotics. In 2009 IEEE/RSJ International Conference on Intelligent Robots and Systems, pages 2228–2234. IEEE, 2009

- Bio-inspired soft design
- 4 fingers configuration: 2 for holding & 2 for maintaining equilibrium
- Different phalanges close angle
- Tendons out of Filaflex and fingertips out of Ecoflex

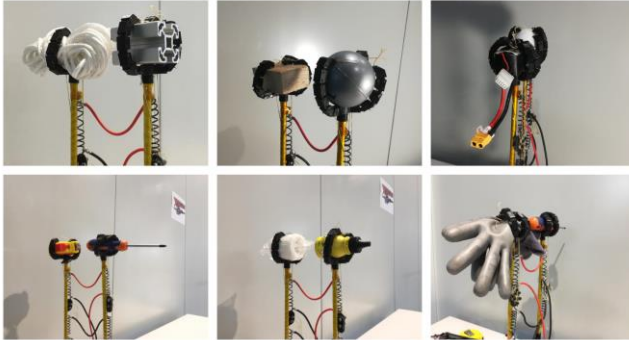


- Bio-inspired design
- Guarantees the actuation
- Maximize actuation force
- Muscle antagonist configuration
- Finger tension adjustment

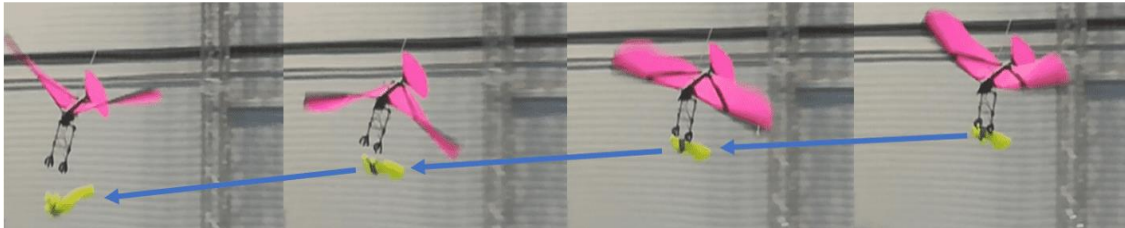




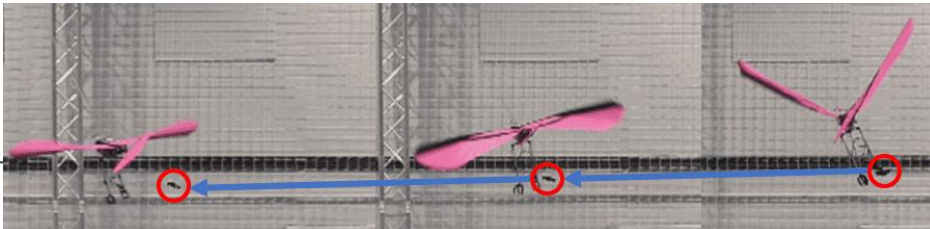
- Perching on a rod, capable of resisting weight forces
- Take-off from a rod, real on flight capabilities
- Experiments with deviation, the system is capable of adapt and relocate the position up to 2-3 cm errors



Grasping Different Objects



Object Delivery



Mini-Drone Delivery



Video



Advanced
Grant



SMA actuated low-weight bio-inspired claws for grasping and perching using flapping wing aerial systems

A. E. Gomez Tamm, V. Perez-Sanchez, B.C. Arrue and A. Ollero





Conclusions

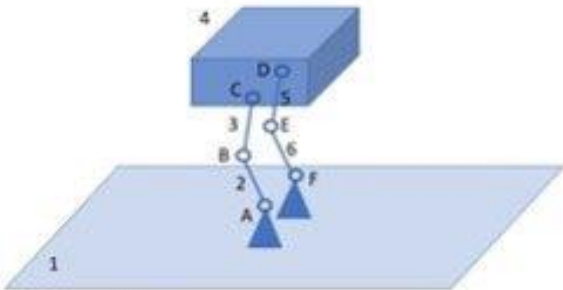


Advanced
Grant

- Soft end-effector for flapping-wing aerial systems
- Characterization of SMA end-effector behaviour
- On flight tests on real systems and integration
- Collaboration with GIM group



- SMA characterization
- Weight optimization
- Improving fly dynamics
- Adding a joint to allow 1 DoF
- Reverse dynamic analysis for a 3D bio-mechanic design



In collaboration with



Advanced
Grant

¡Thanks for your attention!