STUDY OF A MINIATURIZED SOFT BENDING ACTUATOR FOR SURGICAL ENDOSCOPY

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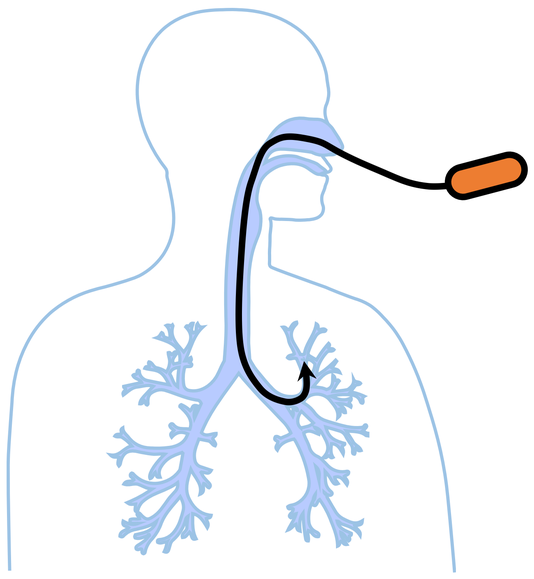
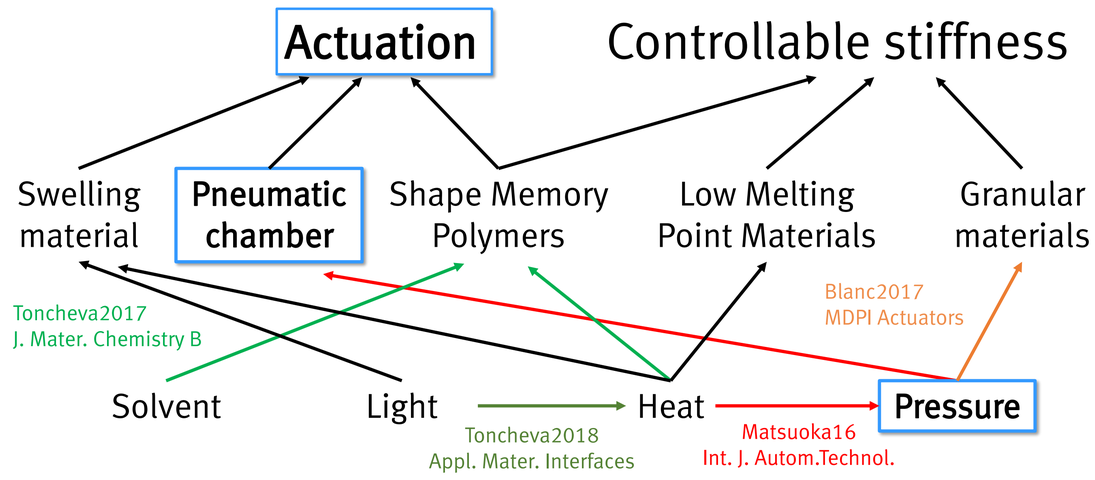
WE NEED **ACTUATED** NAVIGATION TOOLS



- **Soft actuated catheters** could become an alternative to current steerable catheters
- **Softness** minimizes the risk of damage to tissues
- **Miniaturization** enhances possibilities to navigate in confined space and to reach remote locations

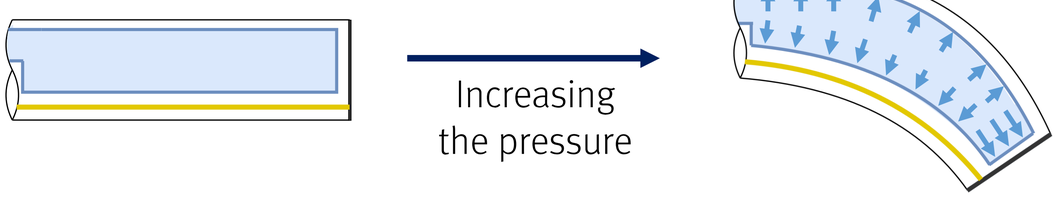
WE HAVE **MANY SOLUTIONS**



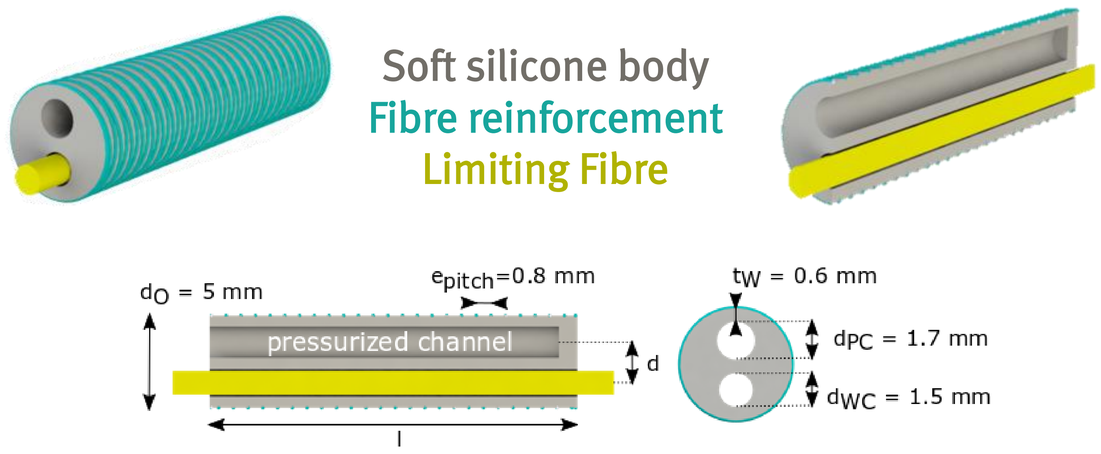
- Many solutions allow **actuation** or **change of stiffness** via a stimulus

FLUIDIC ACTUATION IS SAFE AND INNOVATIVE

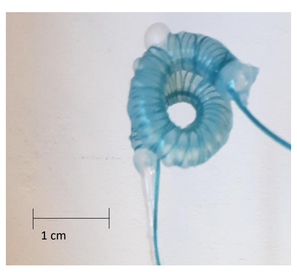
WORKING PRINCIPLE

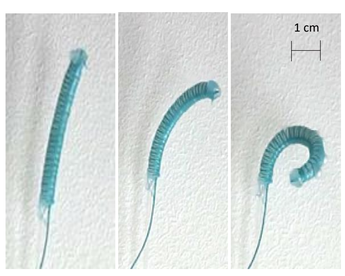


IMPLEMENTED ACTUATOR



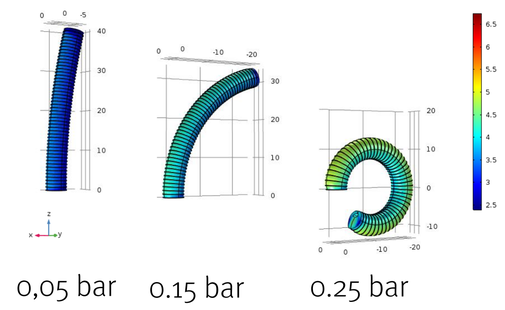
- The limiting fibre can be replaced by **an endoscopic device**, typically the leads of a camera
- **The constant cross-section** simplifies the design and assembly
- The soft silicone body is **moulded** using Ecoflex 0030, and thread is used as limiting fibre





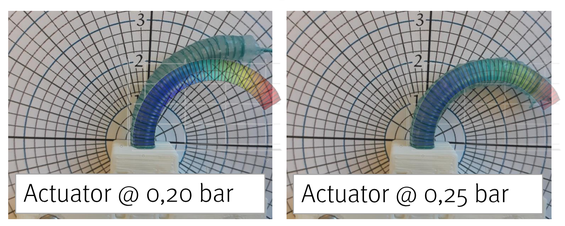
The actuator achieves a **radius of curvature smaller than 10 mm** and develops a **blocking force around 40 mN** at 0,35 bar

A NUMERICAL MODEL IS DEVELOPED



0,05 bar 0.15 bar 0.25 bar

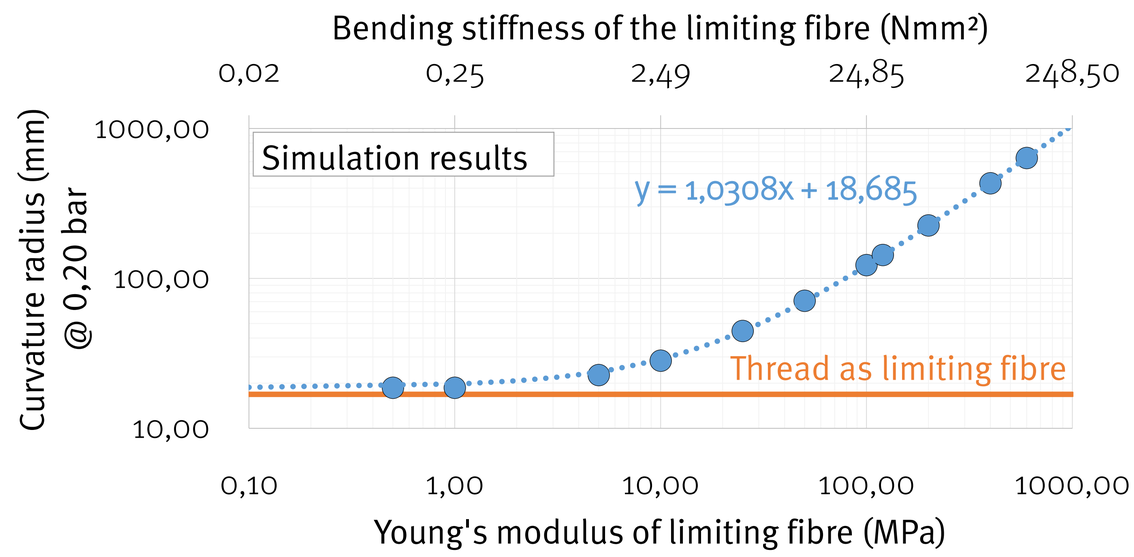
Simulation @ 0,20 bar



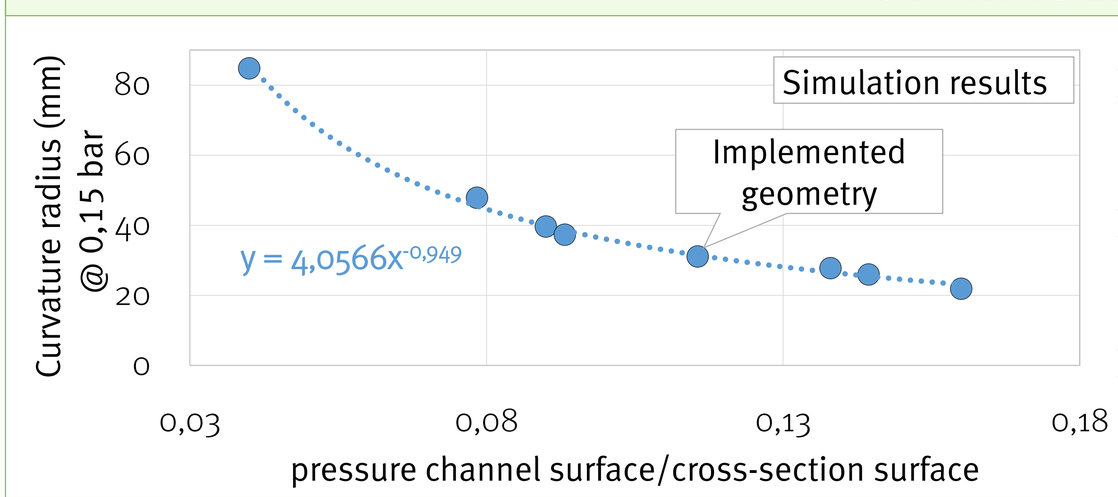
- The numerical model **captures the behaviour** of the actuator
- The bending and the blocking forces are overestimated

THE SOLUTION SHOWS PROMISING RESULTS

- There is no theoretical limitation to **miniaturization**
- The **maximal bending stiffness** of the limiting fibre can be identified



AN **OPTIMISED DESIGN** IS PROPOSED



- **The ratio between the pressure channel surface and the actuator cross-section surface** should be maximized
- Simulation showed promising results concerning the feasibility of an **optimized 3 mm diameter actuator with two degrees of freedom**
- **Further work** will consist in implementing and characterizing the optimized design

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