



Modeling and Control of Continuum Active Catheter for Aortic Aneurysm

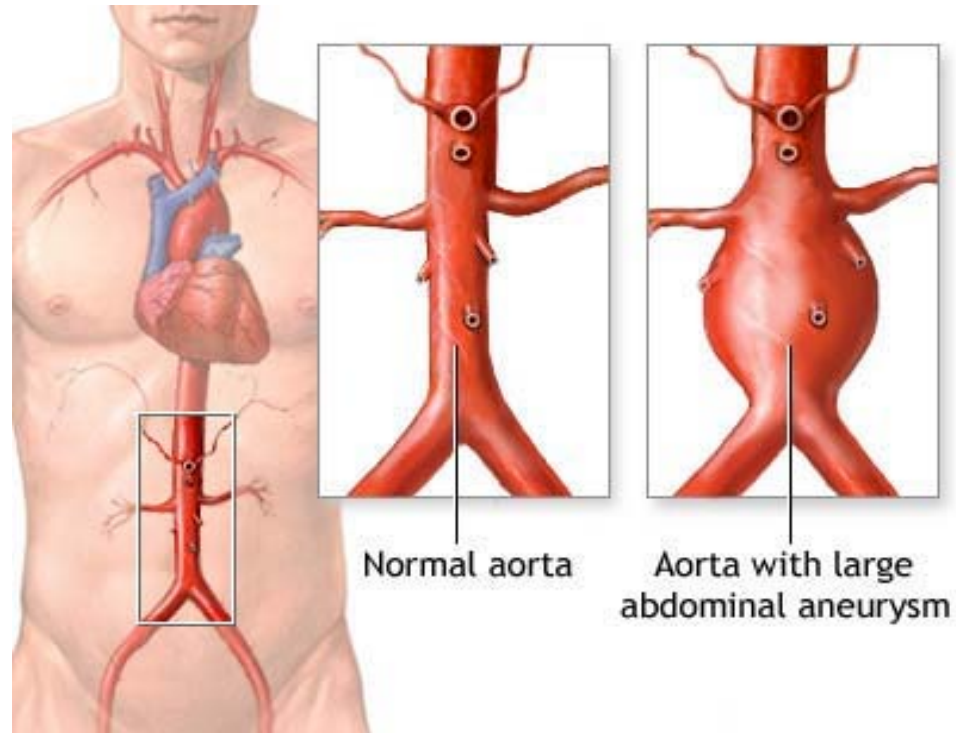
Sohail IQBAL

LISSI Lab, Univ. Paris 12

iqbal@univ-paris12.fr

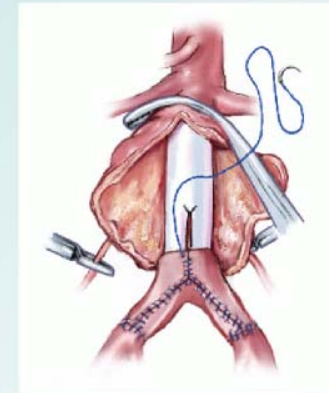
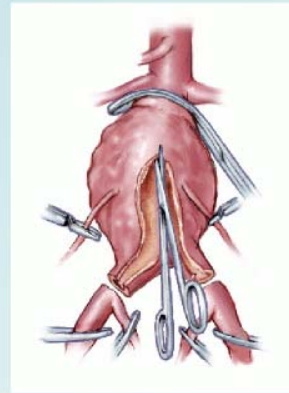
3rd Summer School in Surgical Robotics
Montpellier, September 5-12 , 2007

AORTA AND ANEURYSM



- **Aorta: Largest artery of human body**
 - **Aneurysm: Dilatation of the aorta**
1. **High mortality rate : 80% to 90%**
 2. **13th leading cause of death in the United States**

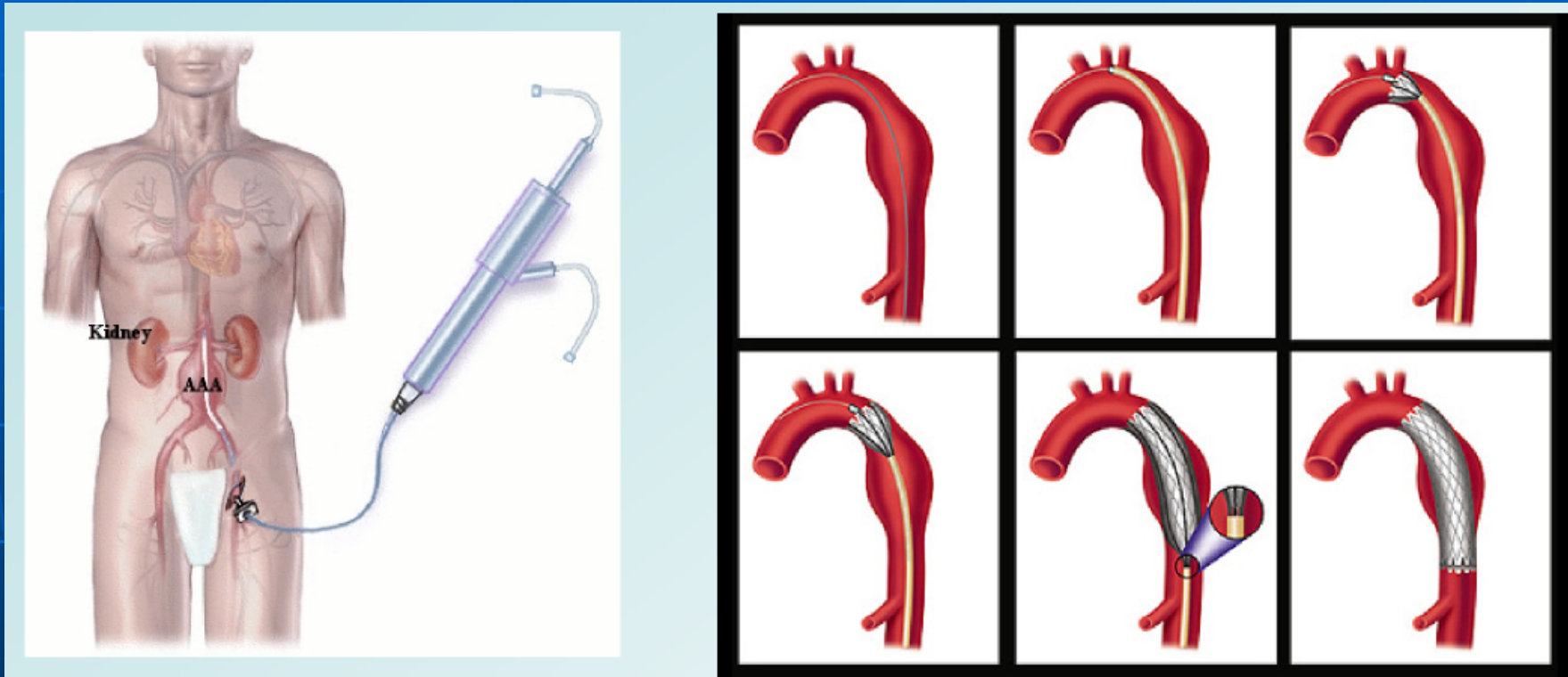
Open Surgery



Drawbacks

- Severe procedure
- Long period of hospitalization and convalescence
- Cost

ENDOVASCULAR STENTING

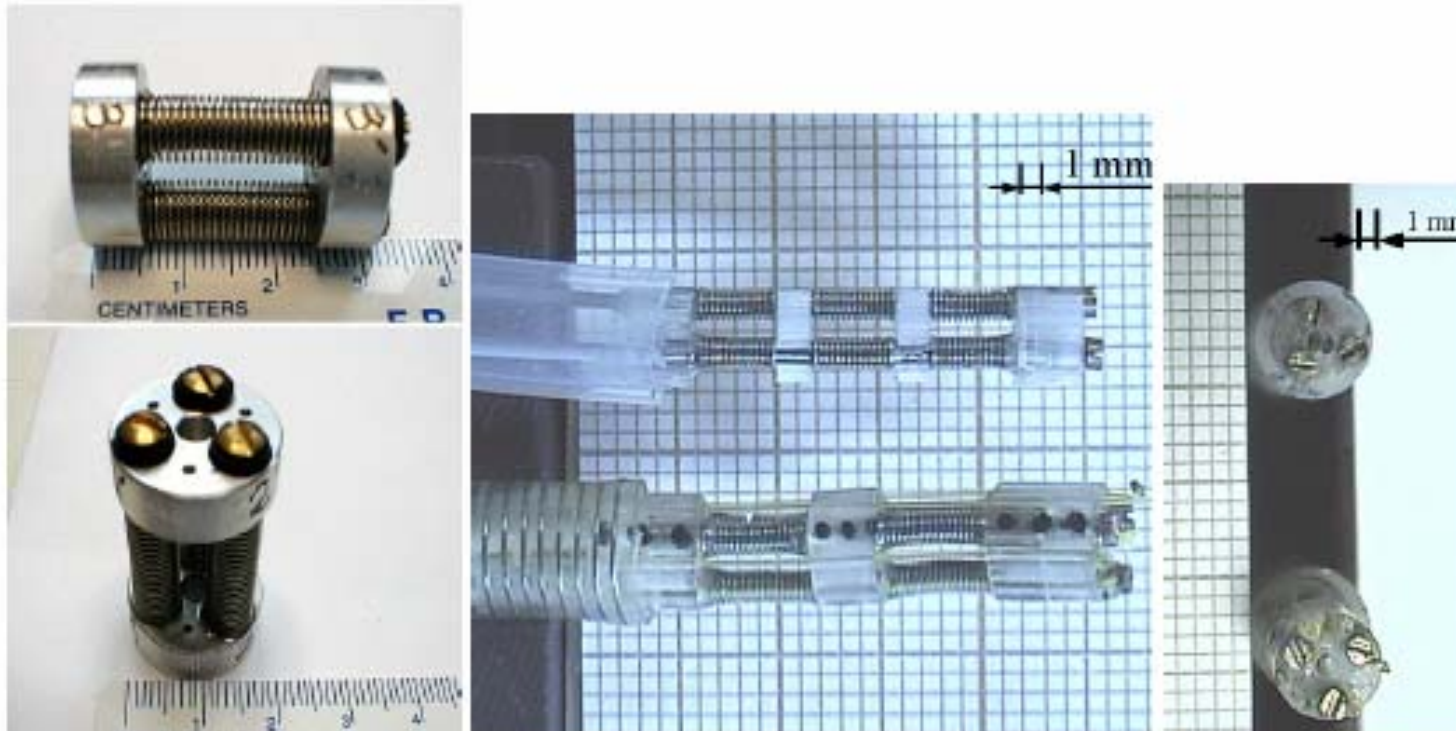


ADVANTAGES:

1. Less trauma
2. Shorter hospitalization
3. Cosmetic benefits
4. Less expensive

Development of Micro-Catheter

Here we can see the three different versions of our Micro catheter:



(a) Version 0, (b) Side View V1 (down) V2 (up) (c) Top view

System of Endovascular Treatment for Aortic Aneurysm

MicroCatheter

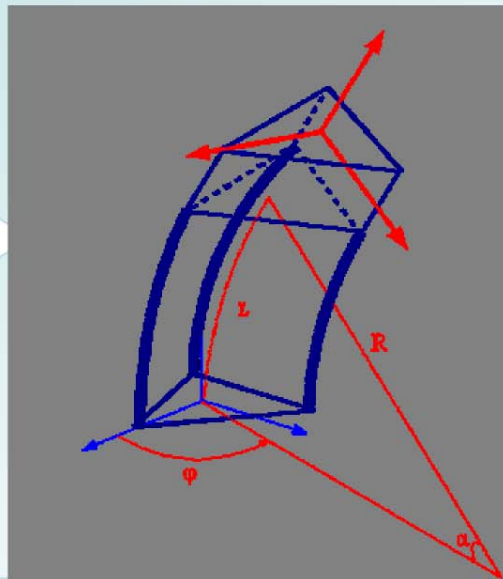
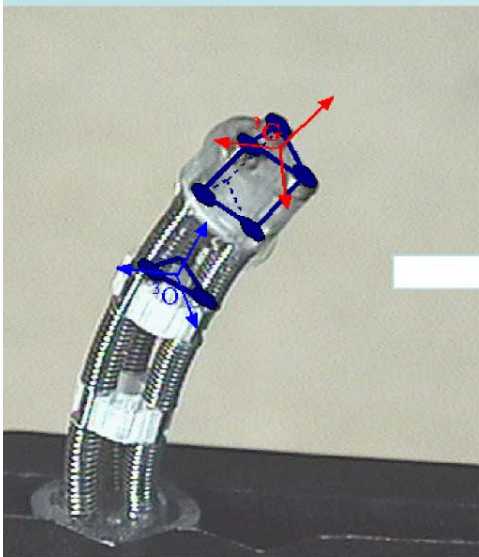
- Structure of micro-robot is inserted in a flexible tube.
- Central Module: Maintains the structural rigidity and prevents the extreme bending of bellows.
- Dimensions of micro-robot: Compatible with the dimension of the standard catheters, used for the treatment of Aortic Aneurysm



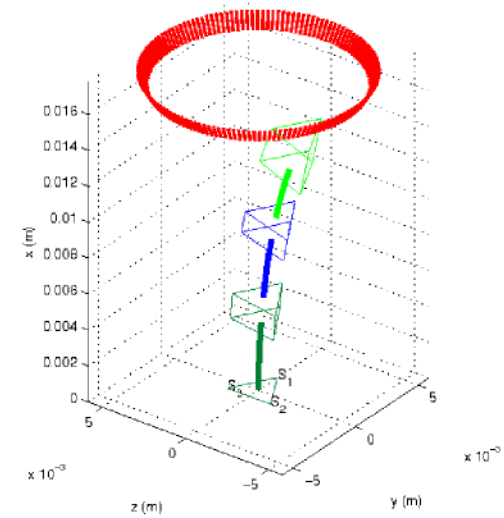
Dimensions of prototype v.2

- Diameter: 4,9 mm
- Length: 20 mm
- Work Channel : 2 mm of diameter

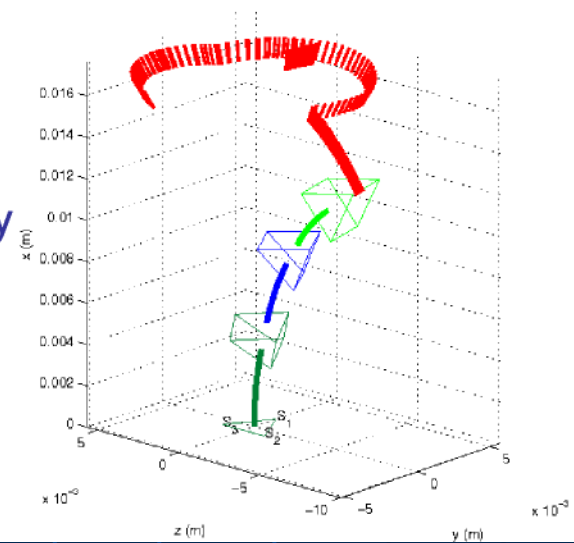
Modeling Highlights



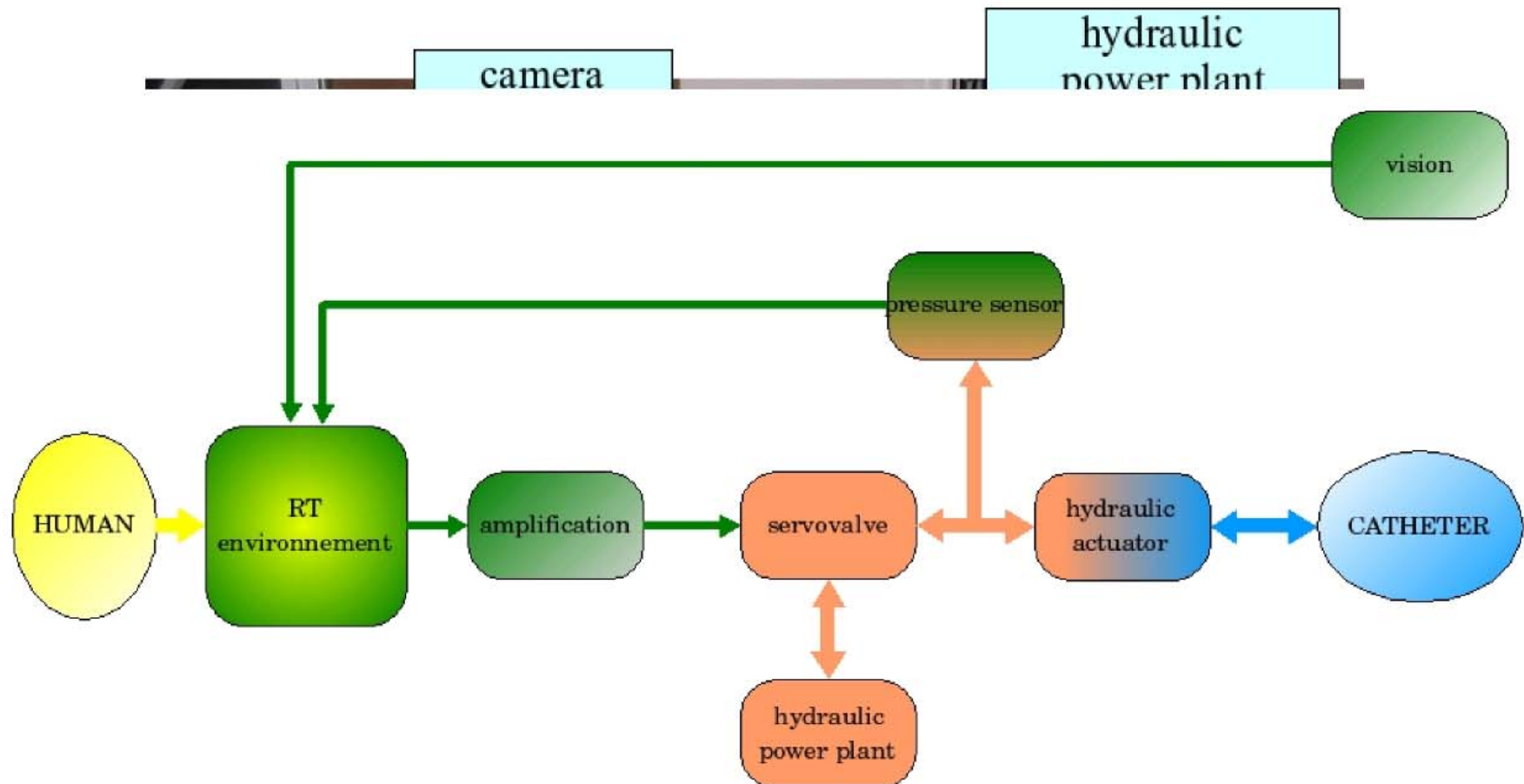
circular trajectory



trajectory



Experimental Set-up



- electric circuit
- hydraulic circuit (oil)
- hydraulic circuit (biocompatible liquid)

prototype v.2

Future Perspectives

1. To perform path planning and its simulations.
2. Error propagation analysis, as a small error in the function linking pressures and lengths of the bellow could be costly at controlling the tool position (Can we take measures to minimize the cumulative error?).
3. Working for the robust and adaptive motion control.

Conclusion

- Design of a new generation of active catheters for aortic aneurysm treatment
- Classification of research categories
- Modeling of a hybrid continuum style micro-robot for N-Modules
- Orientation control with experimental results



Minimal Invasive Surgery by Da-Vinci Surgical System

Thank You for Your Attention!

Questions?