

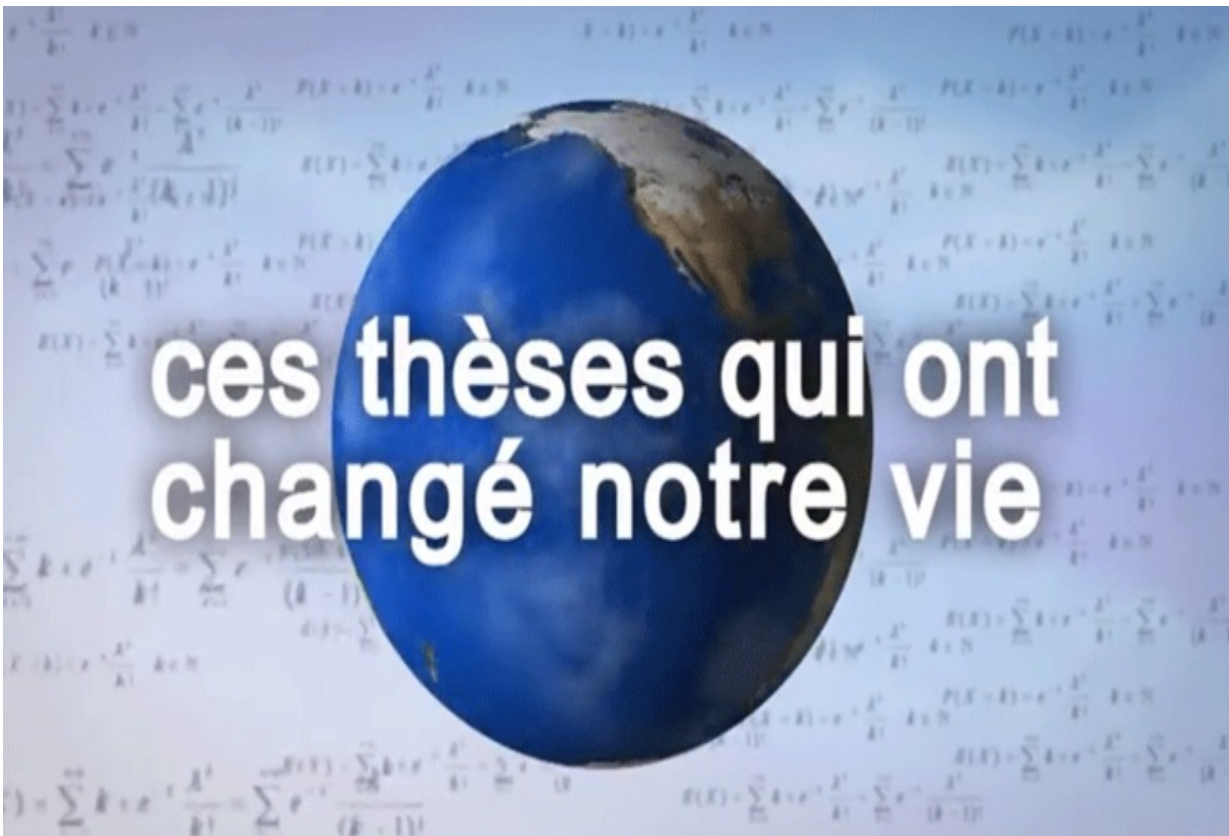
# Interactions UTC

1. [Home](#)
2. [Themes](#)
3. [Doctorate](#)
4. [Special: These theses that change life](#)
5. Digital modelling of fluid-structure interactions in a stenosis arterio-venous window

## Special: These theses that change life

It is a recognized fact that PhDs bring undoubted talents and innovative skills to the world of enterprise. UTC has chosen to present - in text, videos and humoristic photos - some theses that have led to highly beneficial applications in our day-to-day life. We'd like to think that you, the entrepreneurs will be inspired to trust PhDs as recruiting officers do all around the world nowadays!

14 Mar 2016



## Summary

- Digital modelling of fluid-structure interactions in a stenosis arterio-venous window
- prediction of premature birth delivery threats”
- From deliquescence to caking of crystalline powders: sodium chloride
- Sensor networks us to monitor critical situations
- Lower limits and exact computational methods used to solve the bin-packing problem with a set orientation
- “Development of an analytical model used to compute the diffusion matrix for a section comprised of Herschel-Quincke tubes”
- Information and Systems Technologies: safety factors and energy saving for wireless sensors
- “Estimation of semi-Markov chains and hidden semi-Markov chains for applications in reliability assessment and in biology”
- A study of robust, set methods for a reliable multi-sensorial localization. Application for urban vehicle navigation.
- Design and appropriation of a haptic interaction device

designed to detect expressions and communication attitudes

- Contributions to improving permanent magnet, direct current, motors for high-power automobile propulsion applications

## **Digital modelling of fluid-structure interactions in a stenosis arterio-venous window**



The key-word that describes best the life of patients undergoing dialysis is 'patience'. The obligation to go regularly into the dialysis unit for haemodialysis sessions to compensate for a failing kidney and clean impurities from the blood means spending lots of time in

the hospital. In order to have the fastest session possible, the blood flow must be high. This throughput is obtained by surgically placing a window, *viz.*, a sort of tube that interconnects an arm's artery and vein. *"However, creating windows can lead to complications for the patient and there may be stenosis"*, explains Iolanda Decorato.

Iolanda Decorato is a fluid mechanics specialist with her engineering degree (majoring in biomechanics) from the Polytechnic University of Milan; she started her PhD thesis in 2010 at the UTC-BMBI Laboratory, Compiègne.

*"The area I am investigating is the modelling of blood flow characteristics, to see if we can anticipate problems and prepropose solutions"*, she explains. *"To counter the narrowing of a stenosis affected vessel, we can perform an angioplasty to extend the arterial walls using a balloon or a stent coil which effectively consolidates the artery walls."*

The geometric data for each patient (arterial diameters, *etc.*) are recorded by MRI. In parallel, the blood pressures are recorded and these sets of data are then modelised;

*"My objective is to build a reliable digital model in which we only need to input the patient's personal data to help the practitioner make his/her diagnosis and take relevant decisions."* By modelling the blood flow patterns in this way, we can calculate the 'best' flow rate for a dialysis session.

The data acquired can also help clinical surgeons when they have an angioplasty to do, in order to calculate the most efficient final vessel diameter. Or to compare relative advantages of angioplasty vs a stent insert. When a window is introduced, and correctly monitored, it has a 10-15 year operational life expectancy. And, inasmuch as the life expectancy of the dialysis patients themselves is increasing, we must review the lasting parameters of all the medical ancillaries to improve their performance levels.