

The 11<sup>th</sup> International Conference on Advanced  
Engineering Computing and Applications in Sciences  
ADVCOMP 2017

November 12 - 16, 2017 - Barcelona, Spain

**Panel on ADVCOMP/SEMAPRO**  
**Topic: Semantic Approximation and**  
**Optimization in Advanced Computing**

Moderator: Prof. Dean Vucinic  
Vesalius College, Vrije Universiteit Brussel, Belgium  
FERIT, University of Osijek, Croatia

# Panelists

## **Elena Cardillo**

Institute of Informatics and Telematics  
National Research Council, Italy

## **Wladyslaw Homenda**

Warsaw University of Technology, Poland

## **Jon Hjelmervik**

SINTEF, Trondheim, Norway

## **Dean Vucinic**

1. Vesalius College, Vrije Universiteit Brussel, Belgium
2. Faculty of Electrical Engineering, Computer Science and Information Technology (FERIT)  
Josip Juraj Strossmayer University of Osijek, Croatia



Vrije Universiteit Brussel

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of Europe



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<http://www.vub.ac.be/english/index.php>



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<http://www.bruface.be/>

Architectural  
Engineering

- ▶ At a Glance
- ▶ Programme

Chemical and  
Materials Engineering

- ▶ At a Glance
- ▶ Programme
  - ▶ Materials Science
  - ▶ Process Technology

July 4, 2012

## Master Programmes

### Bruface Master Programmes

Starting from the academic year 2011-2012 Université Libre de Bruxelles and Vrije Universiteit Brussel jointly organise the following English taught Master of Science (MSc) programmes

- ▶ **MSc in Architectural Engineering**
- ▶ **MSc in Chemical and Materials Engineering**  
Options **Materials** | **Process Technology**
- ▶ **MSc in Civil Engineering**
- ▶ **MSc in Electromechanical Engineering**  
Options **Aeronautics** | **Energy** | **Mechatronics-Construction** | **Vehicle Technology and Transport**

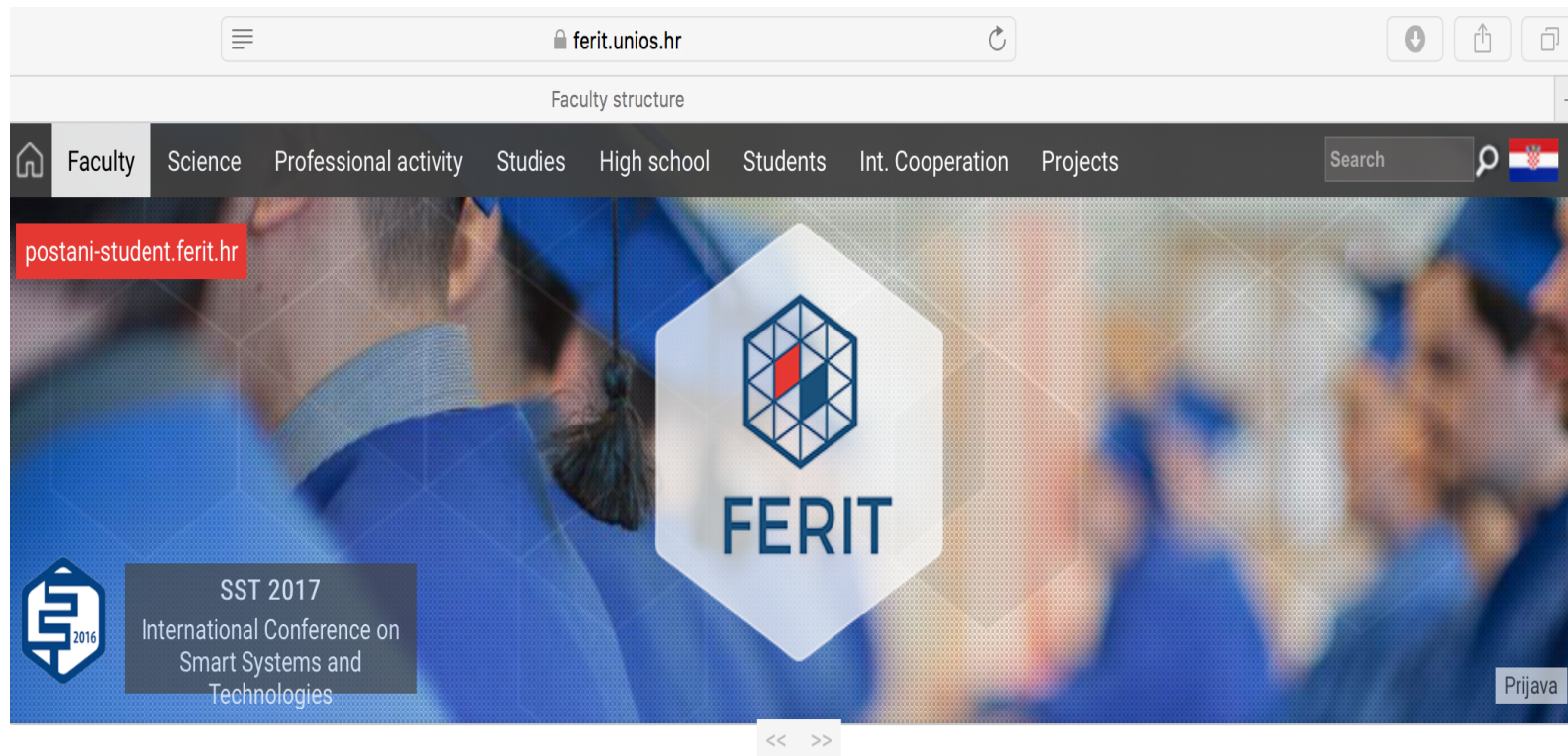
Click [here](#) to find the application procedure and other information concerning the Bruface Master of Science programmes.





# Education at Vesalius College

- **Four BA degrees with a Global Dimension:**
  - Business Studies (Global Business & Entrepreneurship)
  - Global Communications
  - International Affairs
  - International & European Law
- **3 Certificate programs:**
  - Undergraduate Certificate in European Peace and Security Studies (EPSS)
  - Executive Course in Global Risk Analysis and Crisis Management
  - European Business Communication (EBC)
- **MA Programmes (planned for Fall 2017):**
  - MA in Global Peace, Security and Strategic Studies
  - MA in Diplomacy and Global Governance



## Faculty structure

JOSIP JURAJ STROSSMAYER UNIVERSITY OF OSIJEK

Faculty of Electrical Engineering, Computer Science and Information Technology Osijek

Address: Kneza Trpimira 2B, HR-31000 Osijek

<https://www.ferit.unios.hr>



### Faculty structure

Faculty services

Associations

History

Development

# EUROPE

## EUROPEAN UNION

- EU Member States
- EU New Members since 2004
- EU New Member 2013
- EU Candidates
- EFTA Member States





# Elena Cardillo

"The use of **domain-oriented vocabularies** in computer applications helps in avoiding misunderstandings linked to ambiguity, homonymy and synonymy. During the last ten years various artefacts of terminological resources (e.g. thesaurus, classification, nomenclature) have been defined, above all in the health domain, for dedicated use such as disease coding, indexing of biomedical publications, reasoning in decision support systems, data entry into information systems and concept search in multilingual terminology servers. Considerations on the use, performances and integration of domain-oriented vocabularies will be debated focusing on the needs **for achieving semantic interoperability**".

# Wladyslaw Homenda

"Dual Syntax and Semantics Structuring  
in Languages of Natural Communication"



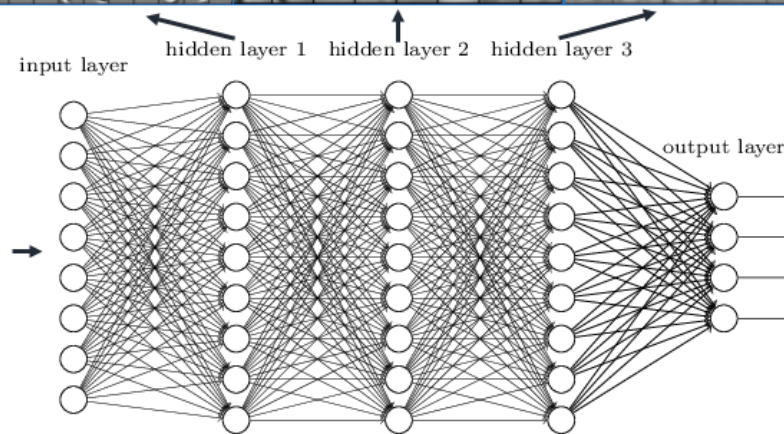
# Jon Hjelmervik

"Machine learning and artificial intelligence have shown great results on selected problems and have drawn a lot of attention lately.

How will the advances affect computing in the years to come?"

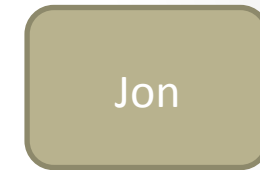
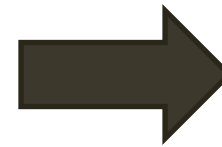
# Feature recognition

Deep neural networks learn hierarchical feature representations

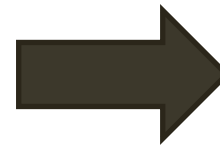


# Deep learning

Face recognition



Speech recognition



Natural language processing



Autonomous cars



# Data driven science

Model driven	Data driven
Inspect input data	Inspect input data
Understand the phenonema	Understand the data
Develop physics model	Clean the data
Create numerical mode	Create ML model

# Physics based modelling vs Data Driven ML

- ☺ Solid foundation based on physics and reasoning
- ☹ Difficult to assimilate very long term historical data into the computational models.
- ☹ Sensitive and susceptible to numerical instability due to a range of reasons (boundary condition, initial conditions, uncertainties in the input parameters)

Memory

Physics

Stability

- ☹ So far most of the algorithms have worked as black boxes
- ☺ Takes into account long term historical data and experiences
- ☺ Once the model is trained, it is very stable for making predictions.

Memory

Physics

Stability

# Predicting the future

Some recent claims:

- We should all become AI programmers
- Robots will take all jobs
- Just another hype



# Dean Vucinic

Multidisciplinary design optimization challenges for the future  
for advancing engineering practice in the years to come?

How the new trends in ExaScale computing power vs. energy  
costs can be easily adopted to provide high quality  
engineering solutions?



# HORIZON 2020

## The EU Framework Programme for Research and Innovation

European Commission > Horizon 2020



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Horizon 2020

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YOUR FEEDBACK

**Project Stories**

# Example of combining several KETs for advanced products

**Societal Challenge**

**Health**



- New nanotechnology-based diagnostics
- New target drug delivery and release
- Regenerative medicine



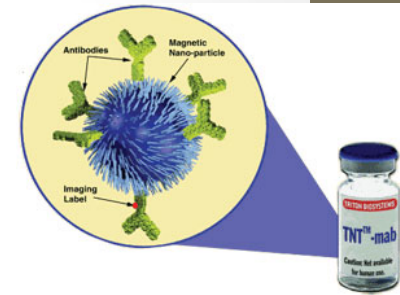
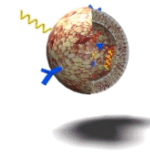
*Nanotechnologies*

*Advanced materials*

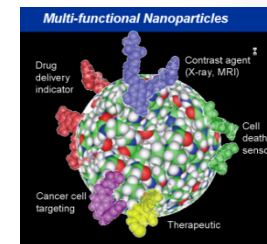
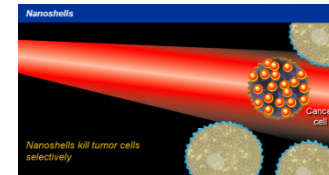
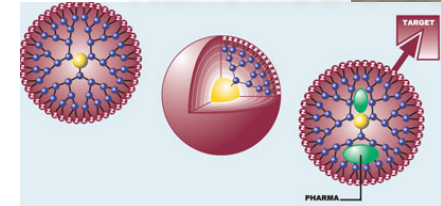
*Microelectronics*

*Photonics*

*Biotechnologies*



**Nanomedicine**



**Dean Vucinic** [dean.vucinic@vub.ac.be](mailto:dean.vucinic@vub.ac.be)

# Computer graphics for engineering => Scientific Visualization => 3D ExaScale Modeling & Simulation Engineering & Computer Science need **tight R&D integration for excellence in SW-HW solutions**

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M.Sc. in Technical Sciences 1987 University of Rijeka  
Ph.D. in Engineering 2007 Vrije Universiteit Brussel

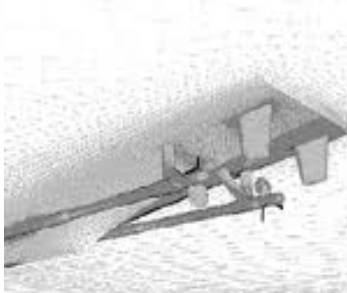
Ph.D. Thesis **Development of Scientific Visualization Systems**

[http://mech.vub.ac.be/thermodynamics/phd/Dean\\_Vucinic.pdf](http://mech.vub.ac.be/thermodynamics/phd/Dean_Vucinic.pdf)

<http://www.amazon.com/Development-Scientific-Visualization-System-Object-Oriented/dp/3838335007>

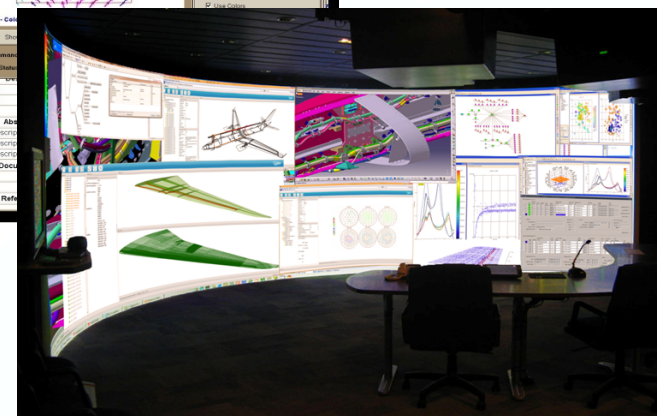
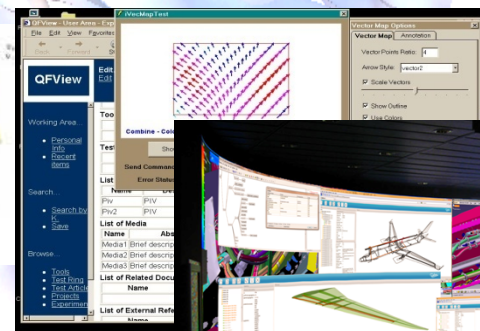
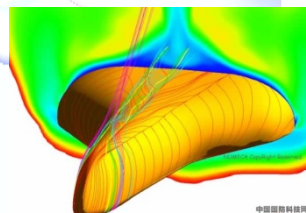
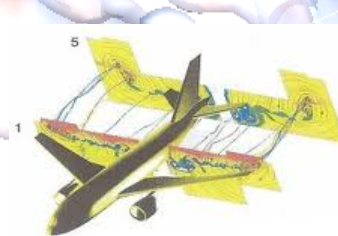
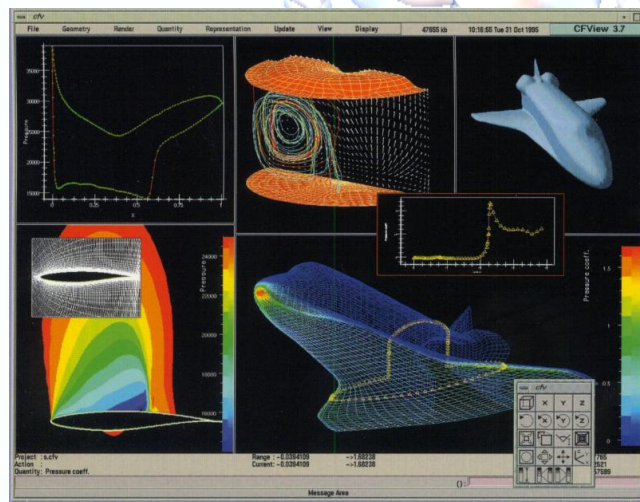
1983-1984 Ship Screw Designer, LIPS, Drunen, The Netherlands  
1984-1988 Naval Architect and CAD/CAM expert, shipyard 3MAY, Rijeka, Croatia  
Part-time Research Assistant at Technical Faculty, University Rijeka  
1988-1998 Ph.D. student, Research Scientist (from 1995) Faculty of Engineering, VUB  
1998-2016 Senior Research Scientist, Professor (10% from 2008) Faculty of Engineering, VUB  
2017-onward Vessalius College, VUB

+20 European projects (FP, ITEA, Tempus), H2020 evaluator, +50 Scientific papers, ~20 PhD-s used CFView



Artist: Kevin Hulsey

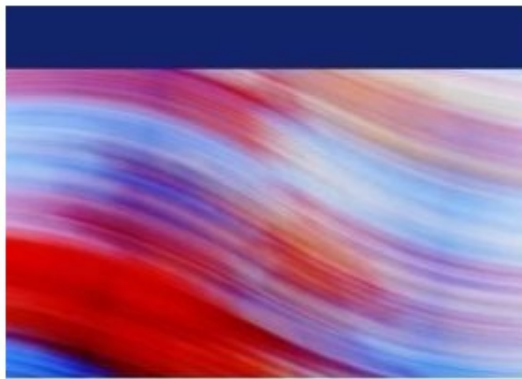
<http://www.khulsey.com>



Hobbies: Tennis (ex-Player), Skiing (Instructor license) and Golf (hdcp 10.5)

# Dean Vucinic PhD Thesis

<http://www.amazon.com/Development-Scientific-Visualization-System-Object-Oriented/dp/3838335007>



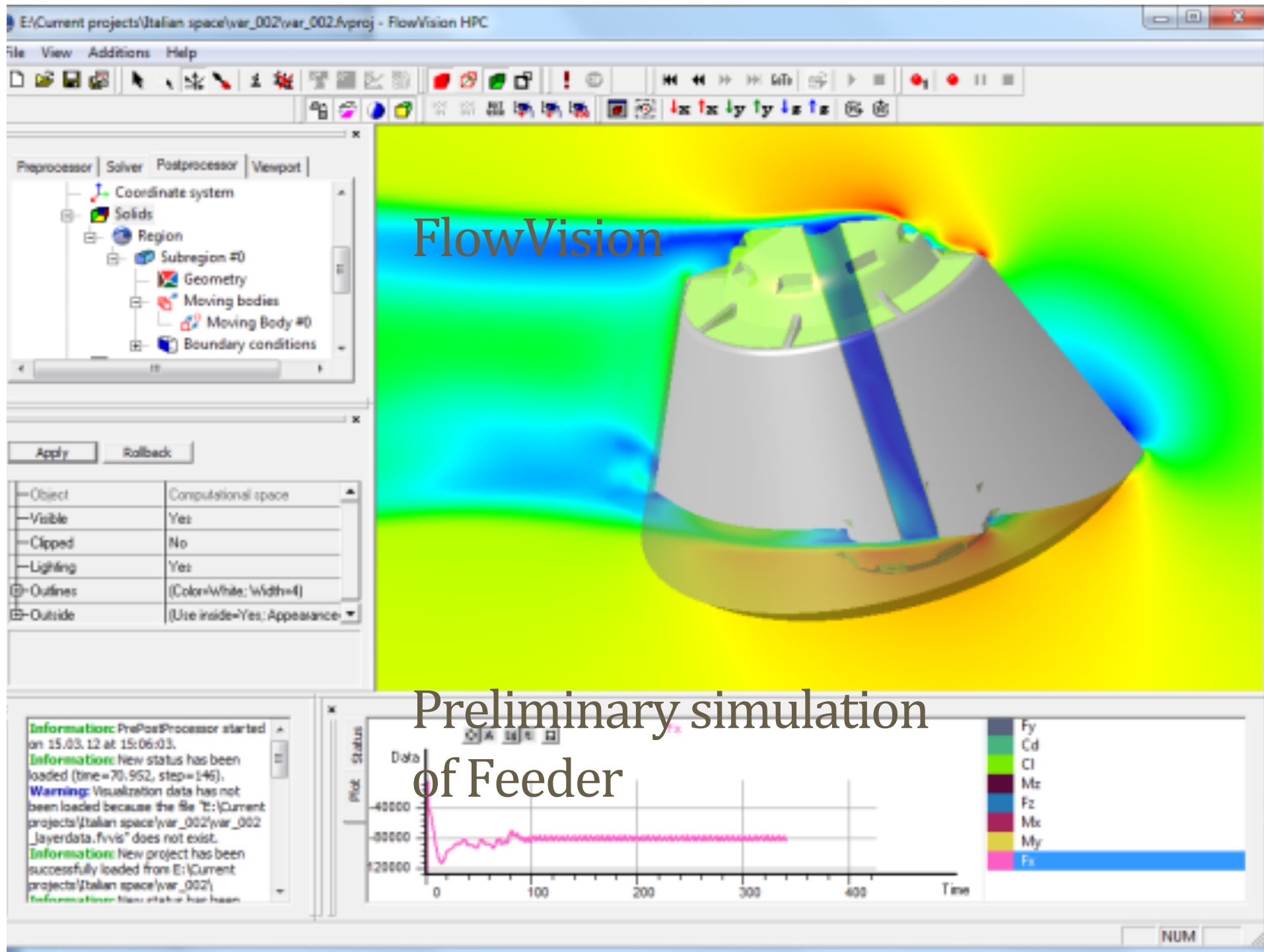
Dean Vućinić

## Development of a Scientific Visualization System

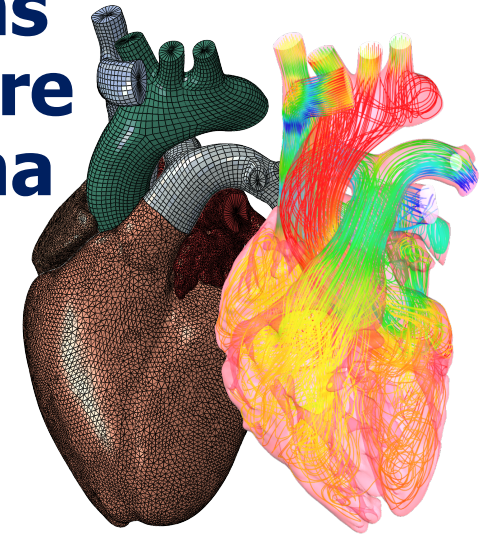
CFView - Computational Field Visualization System and  
Object-Oriented Software Methodology



[http://mech.vub.ac.be/thermodynamics/phd/Dean\\_Vucinic.pdf](http://mech.vub.ac.be/thermodynamics/phd/Dean_Vucinic.pdf)



# Numerical modelling and simulations of human heartbeat as fluid-structure interaction multi-physics phenomena



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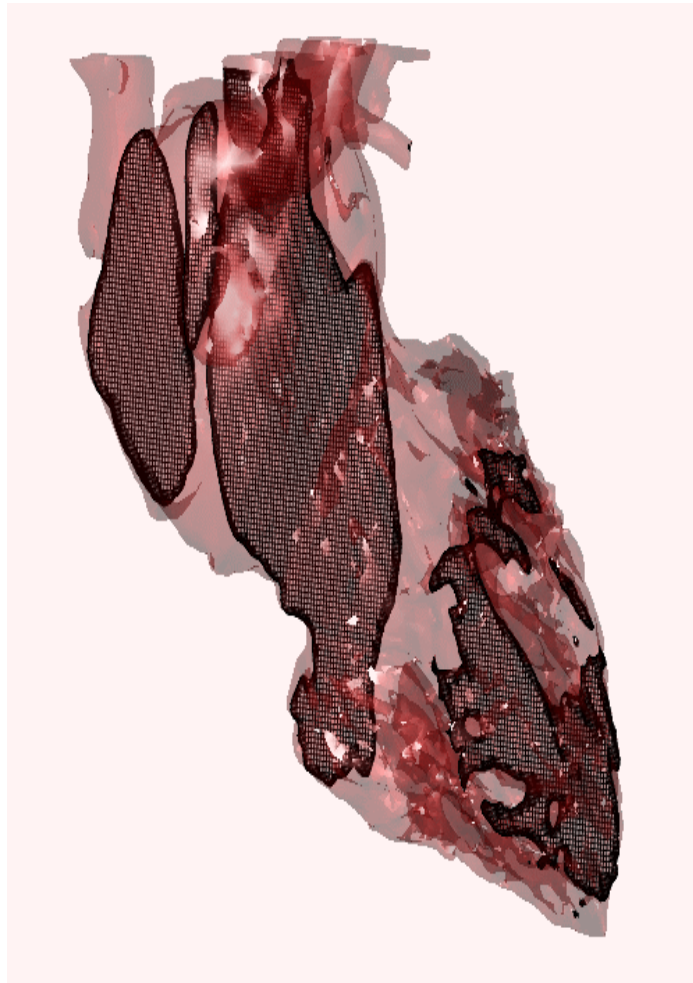
*P. Sridhar, Dassault Systemes Simulia Corporation, USA (epraveen.sridhar@3ds.com)*

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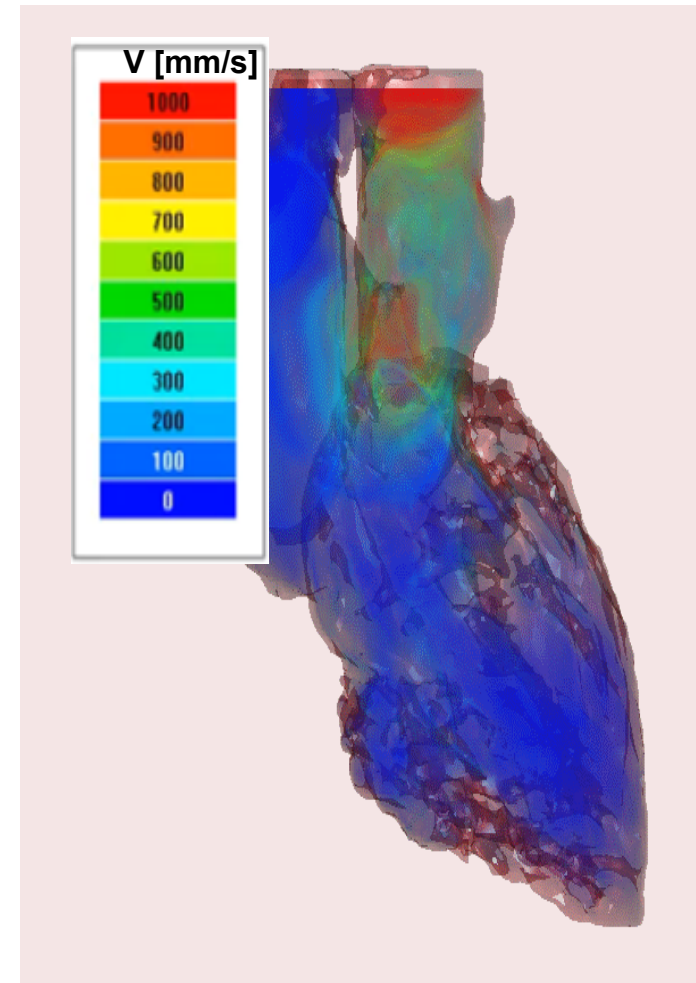
*D. Vucinic VUB, Belgium (dean.vucinic@vub.ac.be)*





**3.2M Computational Cells**

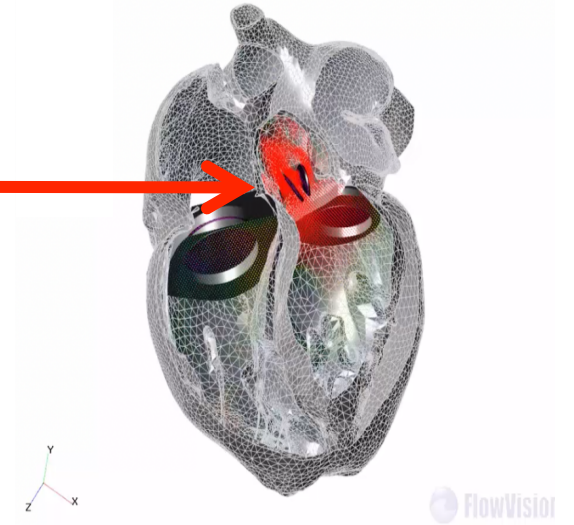
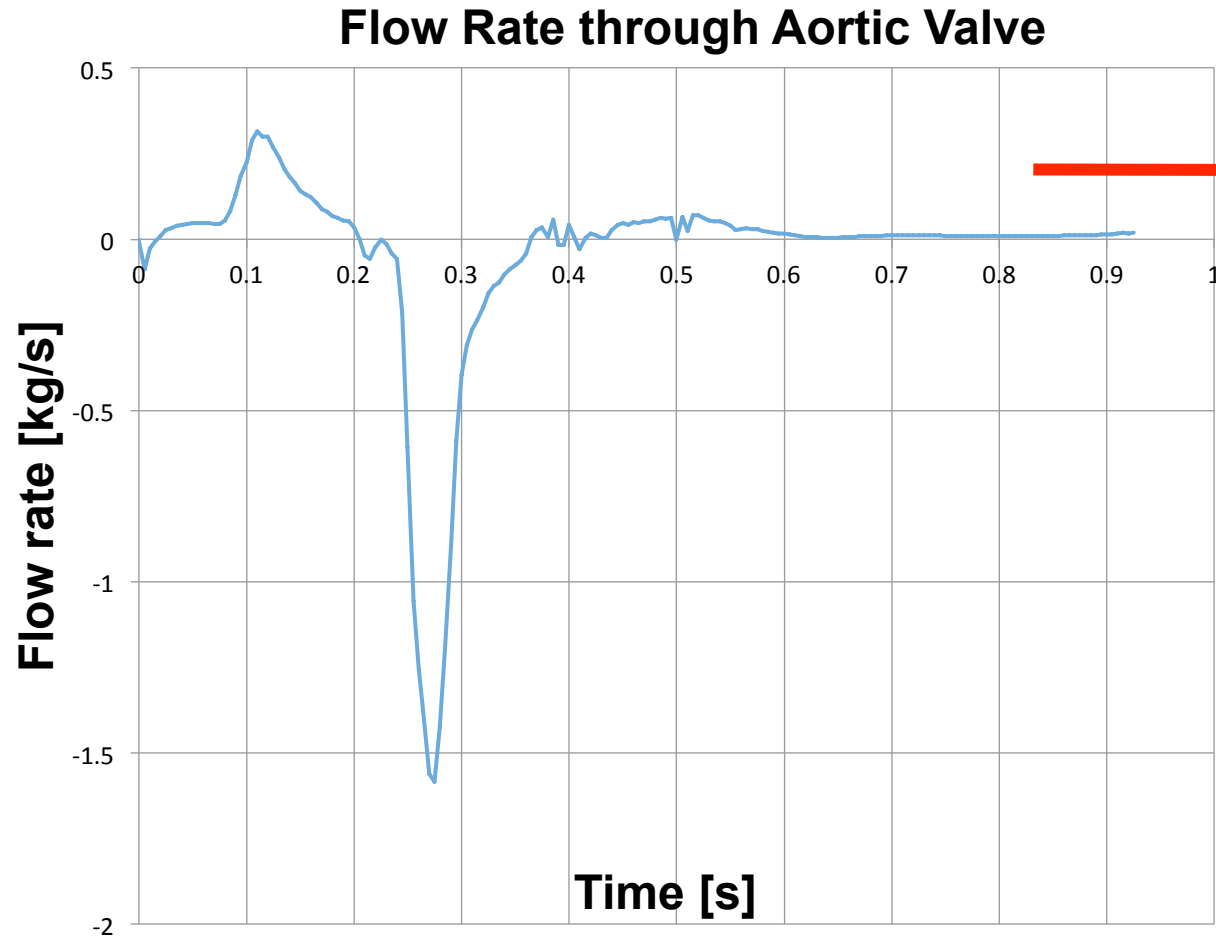
T = 1 seconds  
beat &  
recovery



**Blood Velocity**



# Abaqus/FlowVision FSI Simulation with Mechanical Valves



**Prescribed Movement  
of Mechanical Valves**

**T = 1 seconds  
beat & recovery  
FSI time step =  
 $5e^{-3}$  s**



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