

Titolo del corso: Fluid mechanics for the functional assessment of cardiovascular devices

Docenti: Francesca M. Susin

Programma: The course is intended to give a survey of research approaches for the assessment of cardiovascular medical devices. Emphasis will be given to methods and techniques adopted for in vitro analysis of hemodynamic performance of prosthetic heart valves and total artificial heart. **Topics:** Review of basic fluid mechanics concepts. Fluid mechanics of prosthetic heart valves (PHVs) and ventricular assist devices (VADs). Pulse duplicators for in vitro testing of PHVs and mock circulation loops for pre-clinical evaluation of VADs. Experimental techniques for the assessment of PHVs and VADs performance. CFD for functional assessment of PHVs and VADs.

References:

- [1] M. Grigioni, C. Daniele, G. D'Avenio, U. Morbiducci, C. Del Gaudio, M. Abbate and D. Di Meo. Innovative technologies for the assessment of cardiovascular medical devices: state of the art techniques for artificial heart valve testing. *Expert Rev. Medical Devices*, 1(1) : 81-93, 2004.
- [2] K.B. Chandran, A.P. Yoganathan and S.E. Rittgers. *Bio fluid Mechanics: the human circulation*. CRC Press, Boca Raton, FL, 2007.
- [3] A.P. Yoganathan, K.B. Chandran and F. Sotiropoulos. Flow in prosthetic heart valves: state of the heart and future directions. *Annals of Biomedical Engineering*, 33(12) : 1689-1694, 2005.
- [4] A.P. Yoganathan, Z. He and S. Casey Jones. *Fluid mechanics of heart valves*.
- [5] A.P. Yoganathan and F. Sotiropoulos. Using computational fluid dynamics to examine the hemodynamics of artificial heart valves. *Business briefing: US cardiology 2004* : 1-5, 2004.
- [6] V. Barbaro, C. Daniele and M. Grigioni. Descrizione di un sistema a flusso pulsatile per la valutazione delle protesi valvolari cardiache. *ISTI-SAN Report 91/7*, Rome, Italy, 1991 (in Italian).
- [7] M. Grigioni, C. Daniele, C. Romanelli and V. Barbaro. Banco di prova per la caratterizzazione di dispositivi di assistenza meccanica al circolo. *ISTISAN Report 03/21*, Rome, Italy, 2003 (in Italian).
- [8] M.J. Slepian, Y. Alemu, J.S. Soares. R.G. Smith, S. Einav and D. Bluestein. The Syncardia total artificial heart: in vivo, in vitro, and computational modeling studies. *Journal of Biomechanics*, 46 (2013): 266-27, 2013.

Further references will be given during the course.

Examination and grading: Homework assignment with final discussion.

Testi di riferimento:

References:

- [1] M. Grigioni, C. Daniele, G. D'Avenio, U. Morbiducci, C. Del Gaudio, M. Abbate and D. Di Meo. Innovative technologies for the assessment of cardiovascular medical devices: state of the art techniques for artificial heart valve testing. *Expert Rev. Medical Devices*, 1(1) : 81-93, 2004.
- [2] K.B. Chandran, A.P. Yoganathan and S.E. Rittgers. *Bio fluid Mechanics: the human circulation*. CRC Press, Boca Raton, FL, 2007.
- [3] A.P. Yoganathan, K.B. Chandran and F. Sotiropoulos. Flow in prosthetic heart valves: state of the heart and future directions. *Annals of Biomedical Engineering*, 33(12) : 1689-1694, 2005.
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