Asociación Argentina
de Mecánica Computacional

Mecánica Computacional Vol XXXVI, págs. 13-13 (resumen)
José G. Etse, Bibiana M. Luccioni, Martín A. Pucheta, Mario A. Storti (Eds.)
San Miguel de Tucumán, 6-9 Noviembre 2018

FROM COMPUTATIONAL MECHANICS TO CLINICALLY RELEVANT HAEMODYNAMICS: REQUIREMENTS, CURRENT STATUS AND OUTLOOK

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Keywords: Computational Haemodynamics, CFD, Patient-Specific Computing, Biomedical Engineering, Data Bases, High Performance Computing.

Abstract. The late 1990's saw the first demonstration cases for computational haemodynamics. The last two decades have seen remarkable progress in this field, improving automation and accuracy for patient-specific geometry and boundary conditions, exploring fluid-structure interaction, developing models for thrombosis and haemolysis, as well as many clinically relevant diagnostics. Doing computational mechanics simulations for either basic understanding or design of devices has become commonplace, with many open-source, academic and commercial vendor options/examples. Still, the main question as to the clinical relevance of the physics being modeled and computed remains open. In order to sort with some degree of certainty the many theories as to what is important or not (high or low shear stress, complexity of flows, geometry of aneurysms, etc.), the classic medical approach has been human trials. This implies following many (possibly thousands) of patients over time. In order to test a new theory, or to measure a new quantity deemed as important, one must be able to access and re-run this patient-specific database at any given time. As the number of patients may grow into the tens of thousands, every step of the simulation and evaluation pipeline must be completely automated. The presentation will discuss the requirements in general terms and show an example for a haemodynamic database of the kind envisioned before that now exceeds 2,200 patient-specific cases and is used for virtual clinical trials.