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Editorial

A novel partnership between surgeons and machines, made possible by advances in computing and engineering technology, could overcome many of the limitations of traditional surgery. By extending surgeons' ability to plan and carry out surgical interventions more accurately and with less trauma, Computer-Integrated Surgery (CIS) systems could help to improve clinical outcomes and the efficiency of health care delivery. CIS systems could have a similar impact on surgery to that long since realized in Computer-Integrated Manufacturing (CIM). Mathematical modeling and computer simulation have proved tremendously successful in engineering. Computational mechanics has enabled technological developments in virtually every area of our lives. One of the greatest challenges for mechanists is to extend the success of computational mechanics to fields outside traditional engineering, in particular to biology, the biomedical sciences, and medicine.

The Computational Biomechanics for Medicine Workshop series was established in 2006 with the first meeting held in Copenhagen. The second workshop was held in conjunction with the Medical Image Computing and Computer Assisted Intervention Conference (MICCAI 2007) in Brisbane on 29 October 2007. It provided an opportunity for specialists in computational sciences to present and exchange opinions on the possibilities of applying their techniques to computer-integrated medicine.

Computational Biomechanics for Medicine II was organized into two streams: Computational Solid Mechanics, and Computational Fluid Mechanics and Thermodynamics. The application of advanced computational methods to the following areas was discussed:

- Medical image analysis;
- Image-guided surgery;
- Surgical simulation;
- Surgical intervention planning;
- Disease prognosis and diagnosis;
- Injury mechanism analysis;
- Implant and prostheses design;
- Medical robotics.

We received many more submissions than we could accommodate in a one-day workshop. After rigorous review of full (6–10 pages) manuscripts we accepted 16 papers. Authors of the best five papers were then invited to submit the extended versions of their manuscripts to the Special Section on Computational Biomechanics for Medicine of the Medical Image Analysis Journal. Three of them were accepted.

The first contribution is from Intelligent Systems for Medicine Laboratory at The University of Western Australia. It presents a suite of finite element algorithms for surgical simulation. These algorithms allow computation of soft organ deformations in real time without the oversimplified assumptions of infinitesimal deformations and linear elastic constitutive laws.

The second contribution is from a large research group distributed among Howard Florey Institute, University of New South Wales, University of Melbourne, Alfred Hospital and Monash University, all in Australia. The paper presents a very sophisticated model of the biomechanisms of cortical folding. The computational results were validated through a detailed brain imaging study.

The third paper is from another large group from Georgia Institute of Technology and Emory University in Atlanta and Harvard Medical School in Boston. This paper presents a novel application of the theory of optimal mass transport to multimodal registration of brain images.

Information about Computational Biomechanics for Medicine Workshops, including Proceedings of previous meetings is available at http://cbm.mech.uwa.edu.au/.

We would like to thank the MICCAI 2007 organizers for help with administering the Workshop, the Editors of Medical Image Analysis Journal for creating a Special Section on Computational Biomechanics for Medicine, the authors for submitting high quality work and the reviewers for helping with paper selection.

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