59. ENGINEERING ON ANATOMY: DESIGNING PATIENT SPECIFIC MEDICAL DEVICES AND IMPLANTS

Nikhil Sindhwani

SUMMARY

With rigorous advances in medical imaging modalities and available computational resources, new opportunities to improve patient care are knocking on our doorsteps. The clinical community is getting on board to accept these technological advances and the trend towards personalization of medical care cannot be ignored. Novel techniques are deployed and used for personalized treatment planning, development of more suitable, longer lasting implantable devices in a variety of surgical disciplines. Healthcare centers have started to deploy multidisciplinary teams for developing diagnostic tools, implants, tissue engineered materials and to perform computer assisted surgery, and virtual simulations. Engineering on anatomy is here and it is here to stay.

At the core of these technologies is the use of 3D medical image information of individual patients as well as selected patient populations, combined with computer aided engineering tools and processes. Here we show how these technologies come together to create more stable and efficient, generic and patient specific implantable medical devices. As an example: Figure 1 shows a FEA study to validate a mandible implant and Figure 2 shows a CFD study to predict drug deposition in human lungs. Similar case studies from leading biomedical research institutes as well as medical device manufacturers will be demonstrated for a variety of surgical fields such as orthopaedic, neural, craniomaxillofacial and cardiac surgeries.



Figure 1: FEA study of a patient specific mandibular implant



Figure 2: CFD study to predict drug deposition in human airway system