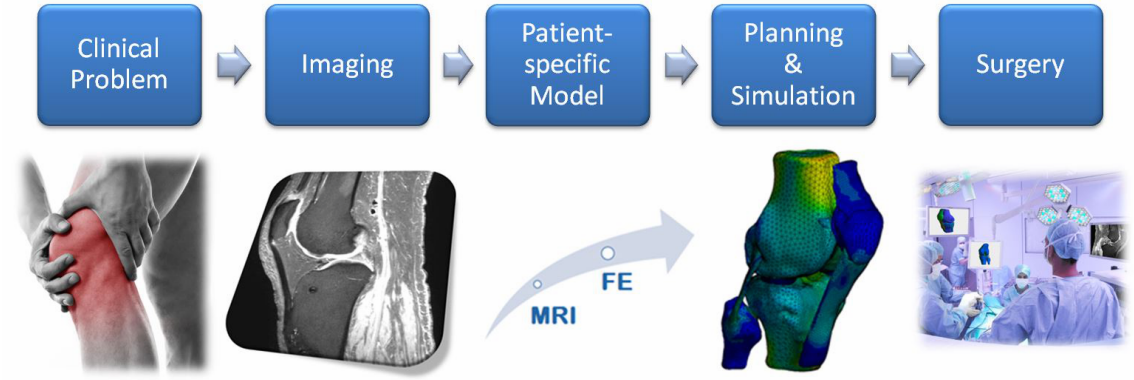
School of Engineering

IMES Institut für Mechanische Systeme

Biomechanical Engineering: NBMI Numerical Based Medical Intervention

In a research project, the basis for a virtual surgery environment was developed. Orthopaedic surgeons are able to simulate their interventions on the computer and prevent risks or postoperative functional limitations.



Orthopedic surgeries on the knee joint due to degenerative changes, such as osteoarthritis are a daily routine in the hospital. An indication of osteoarthritis is a patient with pain in the knee area.
Up to date, a subsequent clinical diagnosis is based on MRI- or CT-scans and the expertise of the surgeon. In case of a surgery, postoperative consequences and therapy options are manly answered by the experience of the surgeon. However biomechanical changes of the knee (e.g. range of motion or ligament tension) due to the adapted anatomy may be difficult to answer.

Virtual second opinion

Patient-specific 3D simulations allow more accurate, economical and efficient interventions in orthopedic surgeries. The Finite Element Method (FEM) is a common computational method for this application. Patient-specific FEM based on medical images has great potential to aid in clinical decision making, designing implants, planning surgeries and monitoring outcomes.
With the Numerical Based Medical Intervention software, the treatment process will be expanded by a virtual second opinion and a surgical planning tool based on functional-mechanical analysis.
Within a very short time surgeons are able to get a patient-specific simulation model which is created automatically, including mechanical-functional constraints. Using the automated FEM simulation, analysis of acting forces and impacts on anatomical structures are possible. This technology integrated into a compact software package offers the establishment of a new quality level in invasive treatments. With an accurate virtual planning of a surgery, the success of the procedure can be increased and postoperative functional limitations can be avoided.

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