Dr.-Ing. Elin Theilen
Principal Scientist & Senior Product Manager
Fraunhofer Institute for Digital Medicine MEVIS
Max-von-Laue-Str. 2
28359 Bremen
Phone +49 421 17879 2233

Patient-specific models for diagnosis, intervention and therapy

An accurate and comprehensive diagnosis is required for optimal treatment to restore joint stability and patient-specific joint kinematics. However, the functionality of the joint can only be properly quantified by analyzing the dynamics, which is not (yet) part of today's clinical practice. It is therefore necessary and important to also include kinematic quantification in order to find the best therapy.
The talk will cover Fraunhofer MEVIS's developments on patient-specific models: From magnetic resonance images of the injured joint, a dynamic and patient-specific biomechanical model can be derived. The evaluation of individual joint kinematics - such as pressure distribution on the cartilage or stresses in ligaments - can be incorporated into the clinical diagnostic and therapeutic process. The simulation of ligament reconstructions, joint implants or osteotomy enables virtual planning of surgical treatment in advance with the aim of achieving the best approximation to the physiological and pre-traumatic joint kinematics. Additionally, methods to derive 3D models of bone structures from X-ray images will be presented.
The presentation includes:

- Automatic segmentation of involved anatomies using deep learning
- Position-based dynamics simulation for interactive kinematic analysis
- Finite Element Simulation for detailed joint analysis
- Statistical shape models