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学位論文題名	Development of Knee Joint CT-FEM Model in Load Response of Stance Phase During Walking Using Muscle Exertion, Motion Analysis, and Ground Reaction Force Data （筋運動、運動解析、床反力データを用いた歩行中の荷重応答期における膝関節 CT-FEM モデルの開発）
論文審査委員	主査　准教授　関根　紀夫 委員　新津　守（埼玉医科大学） 委員　深谷　隆史（つくば国際大学）

【論文の内容の要旨】

There exist no reports on articular stress distribution during walking based on computed tomography (CT)-finite element model (CT-FEM). This study aimed to develop a calculation model of the load response (LR) phase, which is the most burdensome on the knee joint while walking, using the finite element method for quantitative CT images. The right knee of a 43-year-old man without history of osteoarthritis or surgeries of the knee was examined. An image of the knee was obtained using CT, and the extension position image was converted to the flexion angle image in the LR phase. The bone is composed of heterogeneous materials. The ligaments are made of truss elements; therefore, they do not generate strain during expansion or contraction and do not affect the reaction force or pressure. The construction of the knee joint included material properties of the ligament, cartilage, and meniscus. The extensor and flexor muscles were calculated and set as the muscle exercise tension around the knee joint. Ground reaction force was vertically applied to suppress knee rotation, and the thigh was restrained. A FEM model was constructed using a motion analyzer, floor reaction force meter, and muscle tractive force calculation. In a normal knee, relative stress and joint contact reaction force in the LR phase were distributed over a wide area on the inner upper surface of the femur and tibia. We

developed a calculation model in the LR phase of the knee joint during walking using CT-FEM. Methods to evaluate the heteromorphic risk, mechanisms of transformation, and prevention and treatment of knee osteoarthritis may be developed using this model.