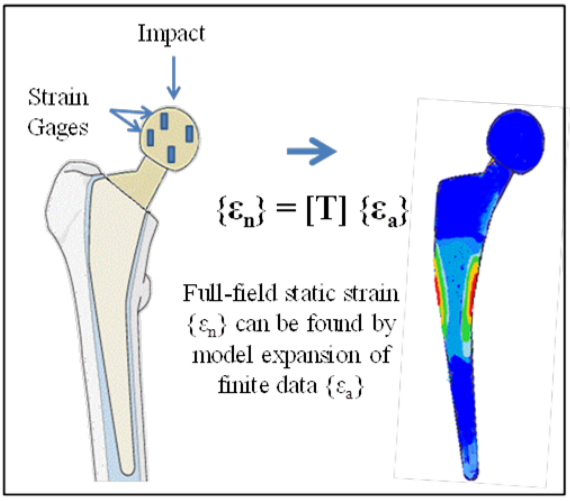
RESEARCH WORK – TINA DARDENO

Model Mapping, Strain Expansion, and Damage Detection as a Methodology for Monitoring Femoral Implant Insertion during Cementless Total Hip Arthroplasty



When a young, active, or heavy person requires hip replacement surgery, orthopedic surgeons typically opt for cementless technology which allows the bone to heal directly to the prosthesis. After removing the femoral head, the surgeon reams the femur to an area slightly smaller than the implant and then press-fits the implant into the femoral canal. Residual stresses from the press fit are required for the implant's stability and the magnitude of these stresses is critical. An implant is properly seated when the stresses are high enough to prevent micro motion of the implant but small enough to avoid femoral fracture. Currently, no device exists to objectively assess implant stability intra-operatively. Surgeons must instead rely solely on their clinical experience to determine seating. To supplement the surgeon's expertise a methodology will be developed using vibration analysis with analytical modeling coupled to strain measurements using digital image correlation (DIC) of exposed regions of the implant. This methodology will form the basis for the design of a real-time interface that will monitor insertion and seating of a cementless femoral implant.

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