Applied Mechanics Group

Applied mechanics research group activities can be classified as:

- Orthopaedics Biomechanics and human body motion analysis.
- Dynamical Systems, Performance Enhancement and Optimal Control
- Population driven search algorithms; biologically or in general inspired from the nature.

Current activities

Orthopaedics biomechanics

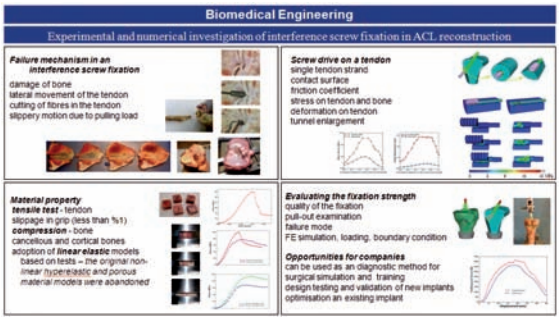
- Development of human body motion modelling for inverse, forward and mixed mode analysis. The modeller developed specifically to analyse micro motion in human joints by treating the articulation based on anatomical surface geometries rather than assuming standard joints. The modeller can perform Boolean operations to study different implant insertions thus enabling evaluation of implants as well as surgical procedures. Accurate joint loading is ensured by using novel muscle wrapping and collision algorithms.
- Joint stiffness definitions and invariants
- Human muscle tremor, calculating individual joint stiffness
- Development of a number of human joint laxity measurement devices.
- Generic human joint simulators
- Development of external fixators to mimic natural joint kinematics, restricting some and allowing other joint mobility.
- Development of feeding bottles for cleft-lipped babies.
- Joint impingement modelling and software.
- Development of expert system for artificial joint selection

Dynamical systems, performance enhancement and robust control

- Novel and generic optimal control strategies applicable to engineering and non-engineering problems
- Active, semi active and self regulating engine mounts.
- Active suspension systems
- Study of rotor dynamics applied to windmill drive line structures.

Biologically and Nature inspired search and optimisation algorithms.

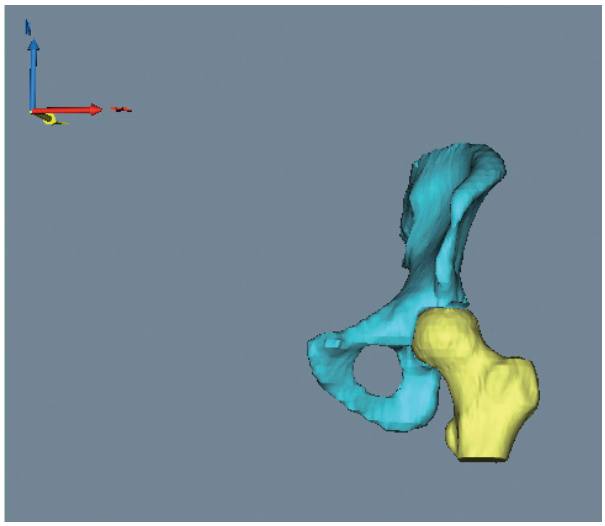
- GA, PSO and Quantum inspired algorithms applied to variety of engineering and non engineering problems



ACL construction and screw fixation

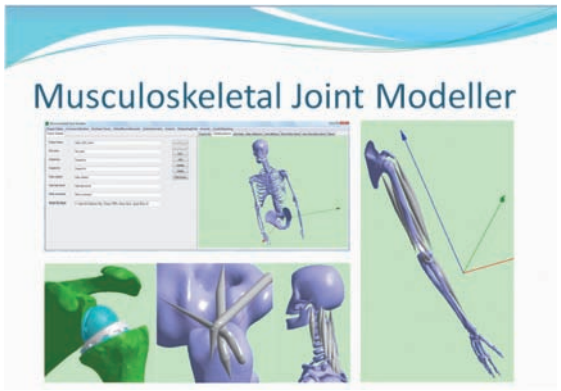
Configurable and programmable, generic joint simulator

Tremor studies, stiffness calculator and forward analysis with joint stiffness

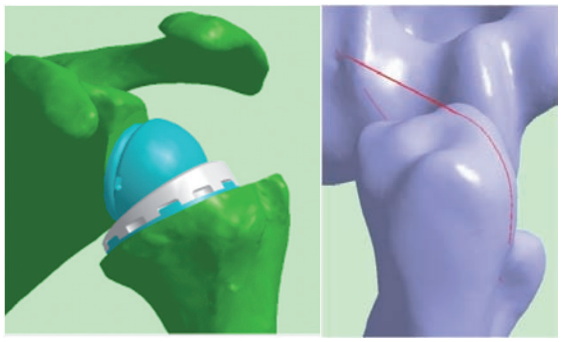


A 3D model of the left pelvis and left femoral head. Both are generated from the CT images provided by using the software Mimics.

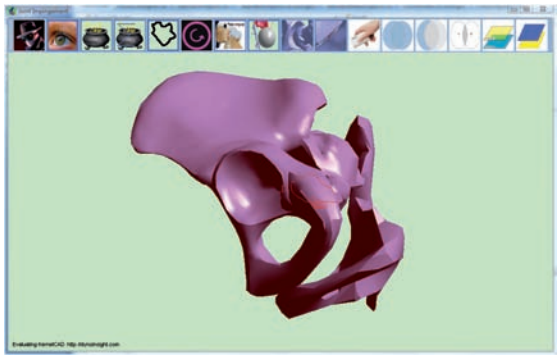
Close collaboration with hospitals



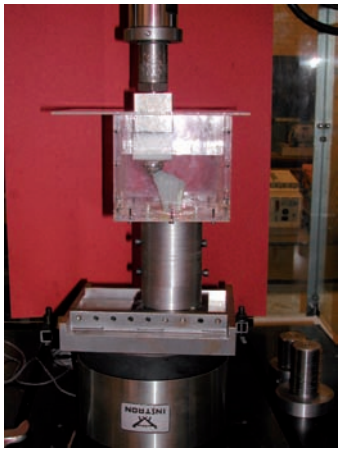
Inhouse human body motion analysis software



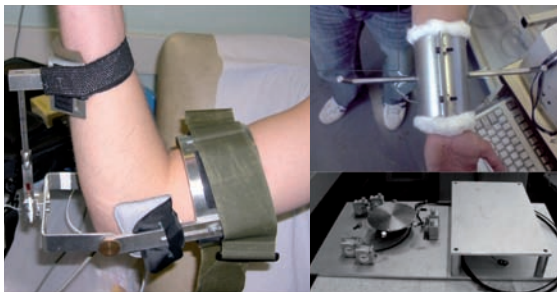
Extracts from MJM (inhouse software) Boolean implant insertion, shortest path for muscle wrapping



Inhouse joint impigement software

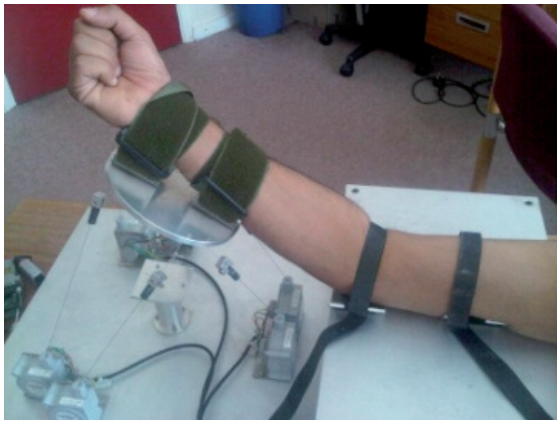


Evaluation of damage mechanism of CFRP femoral prostheses during fatigue testing using acoustic emission



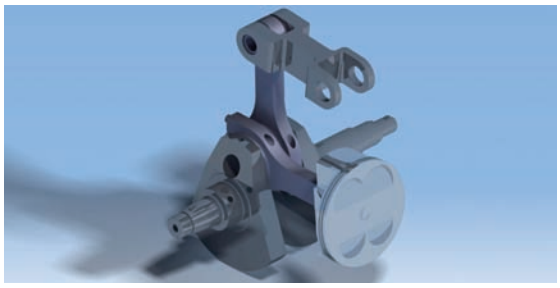
Joint laxity devices

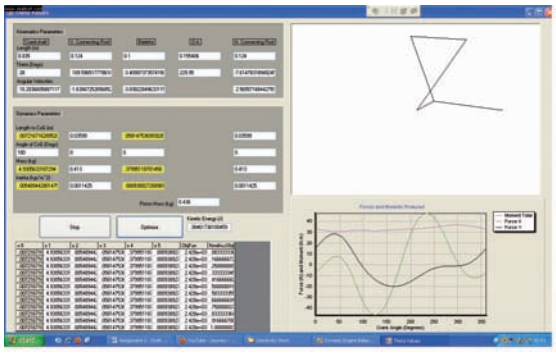
Image based elbow laxity measurement device and software



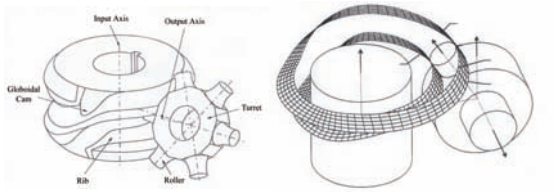
Stewart mechanism used in measuring 6dof joint mobility

Some examples of dynamical systems and their optimisations

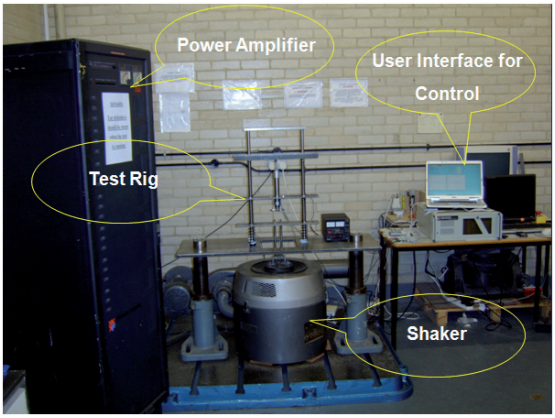




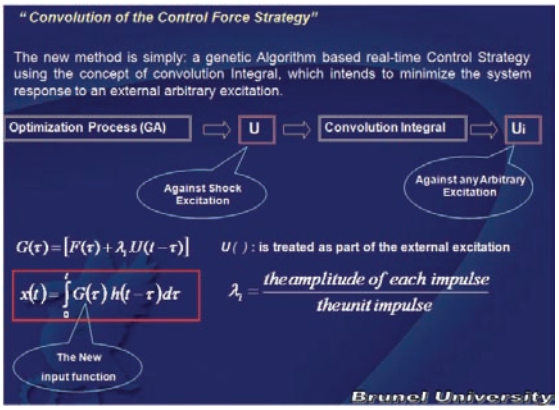
Dyadic single piston engine balancing based on GA



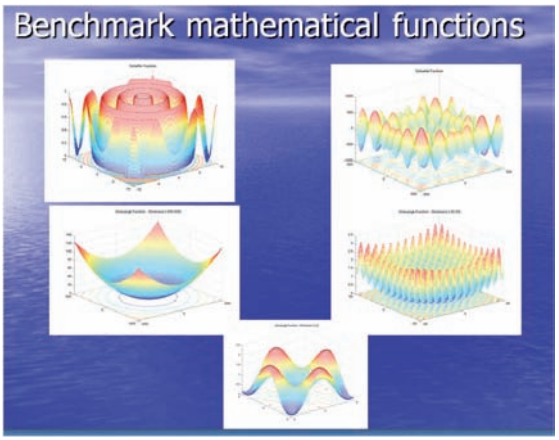
Globoidal Cams – A vectorial analysis of cam surface and GA based optimisation



Theoretical and experimental study of passive, semi active and active suspension systems.



Study of a novel control methodology for optimal control.



Some benchmarks for assessing search algorithms

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