Project proposal

Project title	Optimal design of a magnetically operated expandable hip implant endoprosthesis
First Supervisor	Dr — Demetrios Venetsanos
Second Supervisor	Dr Redha Benhadj-Djilali
School	Mechanical and Automotive Engineering
Other member of supervisory team (no more than three KU supervisors in total)	Mr Eoin Lewis Dr Savvas Vassiliadis
Specific requirements beyond 2:1 degree	First Degree in Mechanical Engineering; Image processing with MatLab; Optimization with MatLab; FEA with Siemens NX

Project summary

(max 4,000 characters)

Primary malignant tumours of bone in children appear mainly at the distal end of the femur. Advances in orthopaedic oncology allow for limb-salvage approaches, such as replacing the distal end of the femur by an implant (endoprosthesis). However, due to skeletal immaturity, a length discrepancy between the patient's femurs will inevitably appear. Expandable hip joint endoprosthesis is a solution to this problem.

The proposed PhD concerns the design and manufacture of a fully functional optimized magnetic-based expandable hip joint endoprosthesis. The innovation concerns the expansion capability principle developed at SMAE/KUL: properly designed magnetic nuts collaborate with a power screw and the nuts are allowed to follow a rotating magnetic ring, which the patient's leg will be placed in during a treatment session.

The proposed phases for this PhD are: (a) image processing of CT scans of a patient's femur-tibia, (b) modelling of the femur–tibia assembly, (c) design of the expandable endoprosthesis, (d) analysis of the femur–tibia–endoprosthesis assembly, (e) optimization and (f) in-vitro experimentations.

MatLab and Siemens NX are highly preferable.