PhD Advert Template

Project title: Modelling Human-Structure Dynamic Interaction on Lightweight Structures

Project ID *(optional)*:

Accept all year-round applications

Funding information: Self-funded students only

Project description: An ever-increasing use of building materials with high strength-to-weight ratios has led to development of slender and lightweight structures with dazzling forms, especially in case of landmark public structures such as footbridges as well as walkways and corridors between buildings, at airports and shopping centres. Such a trend is fuelled by the urgent need to improve sustainability through minimising use of materials in construction. It follows that structures are more sensitive to human-generated dynamic loading than ever before, and their design is largely governed by vibration serviceability limit state. Although theoretical and design methods have been well-established, the design for structural vibration induced by human walking is currently based on loading models obtained on rigid surfaces. It is largely unknown how footstep forces would be modified due to human-structure interaction if the surfaces are vibrating. Pedestrians start interacting with vibrating structures under certain conditions resulting in vibration-dependent dynamic force and unacceptably large errors in predictions of the actual vibration response. To further understand human-structure dynamic interaction under a broad range of conditions, a comprehensive experimental program has been carried out in a world-unique platform and both GRFs and markers trajectories were recorded using force plates and motion capture systems, respectively. The next step is for modelling human walking on vibrating surfaces by implementing biomechanically-inspired bipedal inverted pendulum models and verifying such models against the collected data.

This project combines physical and mathematical modelling to improve understanding of how pedestrian interacts with vibrating structures through a multidisciplinary approaching including human motion science and structural engineering. The output of the project will be a simple bipedal inverted pendulum model of minimum complexity but inclusive of all important parameters derived from testing data analysis to reveal the change in human walking behaviours and facilitate the development of performance-based vibration serviceability design.

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References (optional):

Application enquires: *Dr. Sigong Zhang*

[*https://www.ncl.ac.uk/engineering/staff/profile/sigongzhang.html*](https://www.ncl.ac.uk/engineering/staff/profile/sigongzhang.html)

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[ ]  livestock farming

[ ]  forestry & arboriculture

[ ]  other

Anthropology

[ ]  biological anthropology

[ ]  social anthropology

[ ]  other

Architecture, Building & Planning

[ ]  architecture

[ ]  built environment

[ ]  construction management

[ ]  landscape architecture

[ ]  rural planning

[ ]  surveying

[ ]  urban planning

[ ]  other

Biological Sciences

[ ]  bacteriology

[ ]  behavioural biology

[ ]  biochemistry

[ ]  biodiversity

[ ]  bioinformatics

[ ]  biophysics

[ ]  biotechnology

[ ]  cancer biology

[ ]  cell biology

[ ]  developmental biology

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[ ]  entomology

[ ]  environmental biology

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[ ]  marine biology

[ ]  microbiology

[ ]  molecular biology

[ ]  molecular genetics

[ ]  neuroscience

[ ]  parasitology

[ ]  plant biology

[ ]  plant cell biology

[ ]  reproductive biology

[ ]  structural biology

[ ]  systematic biology

[ ]  virology

[ ]  zoology

[ ]  other

Business & Management

[ ]  accounting

[ ]  business

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[ ]  education management

[ ]  event management

[ ]  hospitality

[ ]  human resource management

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Chemistry

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Communication & Media Studies

[ ]  broadcast media

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[ ]  journalism

[ ]  print media

[ ]  production

[ ]  public relations

[ ]  publishing

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Computer Science

[ ]  artificial intelligence

[ ]  computer architectures

[ ]  computer vision

[ ]  computer graphics

[ ]  cyber security

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[ ]  human computer interaction

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Creative Arts & Design

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[ ]  film studies

[ ]  fine art

[ ]  graphic design

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[ ]  music

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[ ]  photography

[ ]  theatre studies

[ ]  other

Economics

[ ]  econometrics

[ ]  financial economics

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[ ]  microeconomics

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Education

[ ]  further education

[ ]  higher education

[ ]  nursery education

[ ]  primary education

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Engineering

[ ]  acoustics engineering

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[ ]  marine engineering

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[x]  structural mechanics

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[ ]  other

Environmental Sciences

[ ]  climate science

[ ]  hydrology

[ ]  marine sciences

[ ]  meteorology

[ ]  pollution

[ ]  soil science

[ ]  other

Finance

[ ]  actuarial science

[ ]  banking

[ ]  financial management

[ ]  insurance

[ ]  investment

[ ]  taxation

[ ]  other

Food Sciences

[ ]  food hygiene

[ ]  food production

[ ]  other

Forensic and Archaeological Sciences

[ ]  archaeological science

[ ]  forensic science

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Geography

[ ]  agricultural geography

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[ ]  economic geography

[ ]  environmental geography

[ ]  geographical information systems gis

[ ]  historical geography

[ ]  human geography

[ ]  marine geography

[ ]  physical geography

[ ]  political geography

[ ]  remote sensing

[ ]  social geography

[ ]  transport geography

[ ]  urban geography

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Geology

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[ ]  geophysics

[ ]  geoscience

[ ]  geotechnology

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[ ]  marine geology

[ ]  palaeontology

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[ ]  volcanology

[ ]  other

History & Archaeology

[ ]  african history

[ ]  american history

[ ]  ancient history

[ ]  archaeology

[ ]  asian history

[ ]  australasian history

[ ]  british and irish history

[ ]  economic history

[ ]  european history

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[ ]  history of religions

[ ]  history of science

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[ ]  military history

[ ]  modern history

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[ ]  social history

[ ]  world history

[ ]  other

Information Services

[ ]  information security

[ ]  information systems

[ ]  librarianship

[ ]  other

Languages, Literature & Culture

[ ]  african studies

[ ]  american studies

[ ]  asian studies

[ ]  australasian studies

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Law

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[ ]  commercial law

[ ]  contract law

[ ]  property law

[ ]  other

Linguistics & Classics

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[ ]  celtic studies

[ ]  classics

[ ]  latin

[ ]  linguistics

[ ]  other

Materials Science

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[ ]  glass

[ ]  metallurgy

[ ]  polymers

[ ]  textiles

[ ]  other

Mathematics

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[ ]  applied statistics

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[ ]  engineering mathematics

[x]  mathematical modelling

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[ ]  operational research

[ ]  probability

[ ]  pure mathematics

[ ]  statistics

[ ]  stochastic processes

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Medicine

[ ]  anatomy

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[ ]  biomechanics

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[ ]  complementary medicine

[ ]  dentistry

[ ]  endocrinology

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[ ]  nutrition

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[ ]  physiology

[ ]  physiotherapy

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[ ]  speech science

[ ]  tissue engineering

[ ]  toxicology

[ ]  other

Nursing & Health

[ ]  adult nursing

[ ]  community nursing

[ ]  counselling

[ ]  dental nursing

[ ]  environmental health

[ ]  health informatics

[ ]  medical nursing

[ ]  mental health nursing

[ ]  midwifery

[ ]  occupational health

[ ]  occupational therapy

[ ]  paediatric nursing

[ ]  paramedical science

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Philosophy

[ ]  ethics

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Physics

[ ]  acoustics

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[ ]  experimental physics

[ ]  medical physics

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[ ]  optical physics

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[ ]  theoretical physics

[ ]  other

Politics & Government

[ ]  development studies

[ ]  government

[ ]  international relations

[ ]  politics

[ ]  public policy

[ ]  other

Psychology

[ ]  child psychology

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[ ]  developmental psychology

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[ ]  other

Sociology

[ ]  criminology

[ ]  disability studies

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[ ]  socio economics

[ ]  social work

[ ]  other

Sport & Exercise Science

[ ]  sport coaching

[ ]  sport development

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[ ]  sport therapy

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Theology & Religious Studies

[ ]  divinity

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Veterinary Sciences

[ ]  animal welfare

[ ]  veterinary dentistry

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