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*](mailto:Sigong.zhang@newcastle.ac.uk)

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

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You can select up to **10 subject areas**.

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agricultural technology

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livestock farming

forestry & arboriculture

other

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biological anthropology

social anthropology

other

Architecture, Building & Planning

architecture

built environment

construction management

landscape architecture

rural planning

surveying

urban planning

other

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behavioural biology

biochemistry

biodiversity

bioinformatics

biophysics

biotechnology

cancer biology

cell biology

developmental biology

ecology

ecotoxicology

entomology

environmental biology

evolution

genetic engineering

genetics

genomics

human genetics

immunology

marine biology

microbiology

molecular biology

molecular genetics

neuroscience

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management

marketing

project management

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analytical chemistry

applied chemistry

computational chemistry

environmental chemistry

industrial chemistry

inorganic chemistry

organic chemistry

petrochemical chemistry

pharmaceutical chemistry

physical chemistry

polymer chemistry

structural chemistry

synthetic chemistry

other

Communication & Media Studies

broadcast media

digital media

journalism

print media

production

public relations

publishing

other

Computer Science

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computer vision

computer graphics

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data science

human computer interaction

internet of things

machine learning

networks

quantum computing

software engineering

videogames

other

Creative Arts & Design

animation

art

crafts

creative writing

dance

design

drama

fashion

film studies

fine art

graphic design

interior design

music

music technology

photography

theatre studies

other

Economics

econometrics

financial economics

macroeconomics

microeconomics

political economics

other

Education

further education

higher education

nursery education

primary education

secondary education

special needs education

other

Engineering

acoustics engineering

aerospace engineering

atomic engineering

automotive engineering

bioengineering

biomedical engineering

chemical engineering

civil engineering

communications engineering

control systems

cybernetics

dynamics

electrical engineering

electronic engineering

energy technologies

environmental engineering

fluid mechanics

gas engineering

geotechnical engineering

integrated engineering

manufacturing engineering

marine engineering

mechanical engineering

mechanics

mechatronics

nanotechnology

offshore engineering

petroleum engineering

robotics

solid mechanics

structural engineering

structural mechanics

systems engineering

thermodynamics

other

Environmental Sciences

climate science

hydrology

marine sciences

meteorology

pollution

soil science

other

Finance

actuarial science

banking

financial management

insurance

investment

taxation

other

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food hygiene

food production

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archaeological science

forensic science

other

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agricultural geography

cultural geography

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

other

Geology

applied geology

geochemistry

geophysics

geoscience

geotechnology

hydrogeology

marine geology

palaeontology

seismology

volcanology

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History & Archaeology

african history

american history

ancient history

archaeology

asian history

australasian history

british and irish history

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european history

heritage studies

history

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history of religions

history of science

medieval history

military history

modern history

russian history

social history

world history

other

Information Services

information security

information systems

librarianship

other

Languages, Literature & Culture

african studies

american studies

asian studies

australasian studies

chinese

danish

dutch

english language

english literature

european studies

finnish

french

german

italian

japanese

middle eastern studies

norwegian

portuguese

russian

spanish

swedish

other

Law

criminal law

commercial law

contract law

property law

other

Linguistics & Classics

ancient greek

celtic studies

classics

latin

linguistics

other

Materials Science

ceramics

glass

metallurgy

polymers

textiles

other

Mathematics

applied mathematics

applied statistics

computational mathematics

data analysis

engineering mathematics

mathematical modelling

medical statistics

operational research

probability

pure mathematics

statistics

stochastic processes

other

Medicine

anatomy

audiology

biomechanics

cardiology

complementary medicine

dentistry

endocrinology

epidemiology

neural engineering

neurology

nutrition

ophthalmology

optometry

pathology

pharmacology

pharmacy

physiology

physiotherapy

podiatry

radiology

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

surgical nursing

other

Philosophy

ethics

metaphysics

philosophy of science

other

Physics

acoustics

astronomy

astrophysics

chemical physics

computational physics

electromagnetism

environmental physics

experimental physics

medical physics

nuclear physics

optical physics

particle physics

quantum mechanics

solid state physics

space science

theoretical physics

other

Politics & Government

development studies

government

international relations

politics

public policy

other

Psychology

child psychology

clinical psychology

community psychology

counselling psychology

developmental psychology

educational psychology

forensic psychology

health psychology

neuropsychology

occupational psychology

organisational psychology

psychotherapy

sport psychology

other

Sociology

criminology

disability studies

gender studies

socio economics

social work

other

Sport & Exercise Science

sport coaching

sport development

sport performance

sport technology

sport therapy

other

Theology & Religious Studies

divinity

religious studies

theology

other

Veterinary Sciences

animal welfare

veterinary dentistry

veterinary medicine

veterinary nursing

veterinary nutrition

veterinary pathology

other