



**BRE Centre in Sustainable Engineering
BRE Trust Annual Review
Cardiff University (Dec 2015)**

Prepared by Prof Yacine Rezgui
BRE Chair

Key Highlights

Staff:	6 full time academics / 8 Researchers / 1 Visiting Professor
PhDs:	27 currently registered / 11 graduated in 2014 / 2015
Publications:	42 Refereed Journal publications / 13 international conferences
Research projects:	progressing a portfolio of £3.7M for CU out of a £20M research program
Conference Events:	hosted EG-ICE 2014 in Cardiff (80+ international participants)

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Academic Staff

Dr T. Beach (Lecturer)

Tom is a computer Scientist and specializes in Data Analytics, Cloud Storage, High Performance Computing, and Building Information Modelling.

Dr D. Gardner (Senior Lecturer)

Diane has a degree and PhD in Civil Engineering and works on the development of Cementitious, Self-Healing Intelligent Construction Materials that have the benefit of greater longevity with reduced impact on the environment.

Dr A. S. Kwan (Reader)

Alan is a Reader in Structural Mechanics with expertise in Sustainable Informatics, Sustainable Construction, Deployable Structure, Geometric Nonlinearity, and Structural Optimisation.

Prof R. J. Lark (Professor)

Bob is a Chartered Engineer with 40 years of top level Civil Engineering experience in contracting, consultancy, local government and academia. He is a Fellow of the Institution of Civil Engineers and was Chairman of ICE Wales in 2008/09.

Dr H. Li (Senior Lecturer)

Haijiang specialises in advanced and innovative computing based large scale systems integration and decision making in support of sustainable and resilient complex building / infrastructure monitoring, modelling, analysis, optimization and management.

Dr M. Mourshed (Senior Lecturer)

Monjur specializes in building physics, energy simulation, energy planning and forecasting and artificial intelligence.

Prof Y. Rezgui (Professor)

Yacine specializes in semantic engineering with an application in built environment systems modelling, optimization, and decision support.

Research staff

Dr M. Ahmad (Research Assistant)

Dr R. Davies (Research Assistant)

Dr M. J. Dibley (Research Assistant)

Dr J. Hippolyte (Research Assistant)

Dr Y. Liu (Research Assistant)

Dr I. Petri (Research Assistant)

Dr B Yuce (Research Assistant)

Dr W Zhao (Research Fellow)

Honorary staff

Prof Jeffrey Perren

Postgraduate Research

27 Currently Registered PhD students (including 4 co-funded by BRE Trust: Shaun Howell, Yu Li, Korentin Custer, and Jonathan Reynolds).

Julia Jeanne Louise TERLET

Degree: PhD

Title: Water Behaviour Modelling For Efficient ICT-Based Water Management In Urban Environments

Supervisor(s): Prof Y Rezgui, Dr T Beach,

Kumar Biswajit DEBNATH

Degree: PhD

Title: 2050 ENERGY AND CARBON EMISSIONS PATHWAYS: MODELLING THE COST OF DECARBONISATION

Supervisor(s): Dr M Mourshed, Prof Y Rezgui,

Shangjie HOU

Degree: PhD

Title: Integrated implementation of building information modelling in building life cycle.

Supervisor(s): Dr H Li, Prof Y Rezgui,

Shaun Kevin HOWELL

Degree: PhD

Title: ONTOLOGICAL REPRESENTATIONS FOR INTEGRATED SMART CITIES MODELLING AND DATA ANALYTICS

Supervisor(s): Prof Y Rezgui, Dr H Li,

Riyad AL SHAQI

Degree: PhD

Title: HOME CENTRED HEALTHCARE MANAGEMENT IN AN ASSISTED LIVING CONTEXT

Supervisor(s): Dr M Mourshed, Prof Y Rezgui,

EISSA ALRESHIDI

Degree: PhD

Title: A cloud service to outsource and manage built environment data.

Supervisor(s): Dr M Mourshed, Prof Y Rezgui,

Saud ALSHEHRI

Degree: PhD

Title: Biological Preparedness and Disaster Management

Supervisor(s): Prof Y Rezgui, Dr H Li,

Bejay JAYAN

Degree: PhD

Title: Multi-objective optimisation of building design using Energy Simulations & Genetic algorithms.

Supervisor(s): Dr H Li, Prof Y Rezgui,

Yu LI

Degree: PhD

Title: Modelling and Developing "Smart" and "Environmentally Friendly" Engineering Materials

Supervisor(s): Dr H Zhu, Prof Y Rezgui,

Calin Petrut BOJE

Degree: PhD

Title: BIM BASED HOLISTIC MODELLING FOR SUSTAINABLE DEVELOPMENT DECISION MAKING.

Supervisor(s): Dr H Li, Prof Y Rezgui,

Corentin KUSTER

Degree: PhD

Title: DISTRIBUTED CLOUD-BASED SEMANTIC ENERGY MANAGEMENT AT DISTRICT LEVEL.

Supervisor(s): Prof. Y Rezgui, Dr M Mourshed

Keyu CHEN

Degree: PhD

Title: BIM application in modern construction and facility management.

Supervisor(s): Dr H Li, Prof Y Rezgui,

Shang GAO

Degree: PhD

Title: USING BIM TO ENHANCE CONSTRUCTION SAFETY

Supervisor(s): Dr H Li, Dr M Mourshed,

Simeon GOW

Degree: MPhil

Title: Research on BIM based robotics.

Supervisor(s): Dr H Li, Dr A S K Kwan,

Simon LAMB

Degree: PhD

Title: BIM BASED DECISION MAKING SYSTEM FOR HIGHWAYS ASSET MANAGEMENT.

Supervisor(s): Dr H Li, Prof R J Lark,

Raed Fawzi Mohammed AMEEN

Degree: PhD

Title: BIM BASED SUSTAINABLE CITY PLANNING - ARCHITECTURAL ENGINEERING

Supervisor(s): Dr M Mourshed, Dr H Li,

Alex BRADLEY

Degree: PhD

Title: INFRASTRUCTURE-BIM: A CONTRACTORS PERSPECTIVE OF INFRASTRUCTURE INFORMATION MODELLING

Supervisor(s): Dr H Li, Prof R J Lark,

Muhammad Mahfuz Al Hafiz Bin M FAIZAL

Degree: PhD

Title: Model based optimization for zero carbon buildings.

Supervisor(s): Dr M Mourshed, Dr M Bray,

Nada Mohammed Salih MOHAMMED KADHIM

Degree: PhD

Title: The Automated Creation of 3D City Models from Satellite Imagery for Integrated Assessment and Forecasting of Solar Energy Potential

Supervisor(s): Dr M Mourshed, Dr M Bray,

Eman Mohamed Ali ELALWANI

Degree: MPhil

Title: MODELLING EMBODIED ENERGY OF HOUSING STOCK.

Supervisor(s): Dr M Mourshed, Dr T Beach,

Layth Ahmed Kadhm KRAIDI

Degree: PhD

Title: ND Building Information Modelling (BIM) for Lifecycle Management. Specialisation - Construction Engineering and Management.

Supervisor(s): Dr M Mourshed, Dr T Beach,

Luis Molinos PRIEGUE

Degree: PhD

Title:

Supervisor(s): Prof T Stoesser, Dr A S K Kwan,

Abdulhakeem Salem Ali ALTAMEEMI

Degree: PhD

Title: Integrated Security Control Under City Information Moduling - Using Intelligent Control Systems for Providing Full Vision to Decision-Makers in the City Management

Supervisor(s): Dr A S K Kwan, Dr T Beach,

Oliver TEALL

Degree: PhD

Title: MATERIALS FOR LIFE - SELF HEALING CONGLOMERATIVE MATERIALS.

Supervisor(s): Prof R J Lark, Dr D Gardner,

Chuansan MA

Degree: PhD

Title: Numerical Investigation into Moisture Transportation in Cementitious Materials for Self-Healing

Supervisor(s): Dr A D Jefferson, Dr D Gardner, Prof R J Lark

Monica JAYAPRAKASH

Degree: PhD

Title: CAPILLARY FLOW OF AUTOGENIC AND AUTONOMIC HEALING AGENTS IN DISCRETE CRACKS IN CEMENTITIOUS MATERIALS.

Supervisor(s): Dr D Gardner, Dr A D Jefferson,

Stefani Petrova BOTUSHAROVA

Degree: PhD

Title: SELF-HEALING IN SOILS.

Supervisor(s): Dr M Harbottle, Dr D Gardner,

11 graduated over 2014-2015**Abdulrahman Abdullah Hamad ALSULIMAN**

Degree: PhD

Title: Investigating the Influence of Information Systems Applications on Quality of Electronic Service in Municipal Sector: A study of acceptance of e-municipality services

Supervisor(s): Prof Y Rezgui, Dr A S K Kwan,

Tala KASIM

Degree: PhD

Title: BIM-Based Smart Compliance Checking to Enhance Environmental Sustainability

Supervisor(s): Dr H Li, Prof Y Rezgui, Dr T Beach

Bin WANG

Degree: PhD

Title: End User Oriented BIM Enabled Multi-Functional Virtual Environment Supporting Building Emergency Planning and Evacuation

Supervisor(s): Dr H Li, Prof Y Rezgui,

Abdulaziz Abdullah Hamad ALSULAIMAN

Degree: PhD

Title: An Integrated User-Centric Platform To Promote Sustainable Behaviour

Supervisor(s): Prof Y Rezgui, Dr A S K Kwan, Dr M Mourshed

Naief Ali Rasheed ALDOSSARY

Degree: PhD

Title: Domestic Sustainable and Low Energy Design in Hot Climatic Regions

Supervisor(s): Prof Y Rezgui, Dr A S K Kwan,

Saleh ALYAMI

Degree: PhD

Title: THE DEVELOPMENT OF SUSTAINABLE BUILDING ASSESSMENT METHOD FOR SAUDI ARABIA BUILT ENVIRONMENT

Supervisor(s): Prof Y Rezgui, Dr A S K Kwan,

Wadhah Amer HATEM

Degree: PhD

Title: Comparing The Effectiveness of Face To Face And Computer Mediated Collaboration In Design

Supervisor(s): Prof J C Miles, Dr A S K Kwan,

Robert Scot MCLEOD

Degree: PhD

Title: An Investigation Into The Applicability Of The Passivhaus Standard For The UK Context

Supervisor(s): Dr A S K Kwan, Prof Y Rezgui,

Najmadeen Mohammed SAEED

Degree: PhD

Title: Prestress and deformation control in flexible structures

Supervisor(s): Dr A S K Kwan, Prof Y Rezgui,

James BRAMMER

Degree: PhD

Title: Physical and Numerical Modelling of Marine Renewable Energy Technologies, with {Articular Focus on Tidal Stream And Tidal Range Devices

Supervisor(s): Prof R A Falconer, Dr A S K Kwan,

Tobias HAZELWOOD

Degree: PhD

Title: Investigation of a Novel Self-Healing Cementitious Composite Material System

Supervisor(s): Prof R J Lark, Dr A D Jefferson, Dr D Gardner

Published Refereed Journals (2014/2015)

1. Yuce, B; Rezgui, Y., Mourshed, M. (2015) ANN-GA Smart Appliance Scheduling for Optimized Energy Management in the Domestic Sector, *Energy & Buildings*, DOI: 10.1016/j.enbuild.2015.11.017.
2. Aldossary N, Rezgui Y, Kwan AS, Consensus-based low carbon domestic design framework for sustainable homes, *Renewable and Sustainable Energy Reviews* , 51 (2015) 417-432 ISSN 1364-0321 10.1016/j.rser.2015.05.070
3. Aldossary N, Rezgui Y, Kwan AS, An investigation into factors influencing domestic energy consumption in an energy subsidized developing economy, *Habitat International* , 47 (2015) 41-51 ISSN 0197-3975 10.1016/j.habitatint.2015.01.002
4. Alreshidi E, Mourshed M, Rezgui Y, Cloud-based BIM governance platform requirements and specifications: software engineering approach using BPMN and UML, *Journal of Computing in Civil Engineering* , (2015) ISSN 0887-3801 10.1061/(ASCE)CP.1943-5487.0000539
5. Alshehri SA, Rezgui Y, Li H, Delphi-based consensus study into a framework of community resilience to disaster, *Natural Hazards* , 75 (3) (2015) 2221-2245 ISSN 0921-030X 10.1007/s11069-014-1423-x
6. Alshehri SA, Rezgui Y, Li H, Disaster community resilience assessment method: a consensus-based Delphi and AHP approach, *Natural Hazards* , 78 (1) (2015) 395-416 ISSN 0921-030X 10.1007/s11069-015-1719-5
7. Beach T, Rana OF, Rezgui Y, Parashar M, Governance model for cloud computing in building information management, *IEEE Transactions on Service Computing* , 8 (2) (2015) 314-327 10.1109/TSC.2013.50
8. Beach T, Rezgui Y, Li H, Kasim T, A Rule-based semantic approach for automated regulatory compliance in the construction sector, *Expert Systems with Applications* , 42 (12) (2015) 5219-5231 ISSN 0957-4174 10.1016/j.eswa.2015.02.029
9. Beach T, Rezgui Y, Li H, Kasim T, A rule-based semantic approach for automated regulatory compliance in the construction sector, *Expert Systems with Applications* , 42 (12) (2015) 5219-5231 ISSN 0957-4174 10.1016/j.eswa.2015.02.029
10. Alyami SH, Rezgui Y, Kwan AS, The development of sustainable assessment method for Saudi Arabia built environment: weighting system, *Sustainability Science* , 10 (1) (2015) 167-178 ISSN 1862-4065 10.1007/s11625-014-0252-x
11. Dibley MJ, Li H, Rezgui Y, Miles J, An integrated framework utilising software agent reasoning and ontology models for sensor based building monitoring, *Journal of Civil Engineering and Management* , 21 (3) (2015) 356-375 ISSN 1392-3730 10.3846/13923730.2014.890645
12. Hou S, Li H, Rezgui Y, Ontology-based approach for structural design considering low embodied energy and carbon, *Energy and Buildings* , 102 (2015) 75-90 ISSN 0378-7788 10.1016/j.enbuild.2015.04.051
13. Petri I, Rezgui Y, Beach T, Li H, Arnesano M, Revel GM, A semantic service-oriented platform for energy efficient buildings, *Clean Technologies and Environmental Policy* , 17 (3) (2015) 721-734 ISSN 1618-954X 10.1007/s10098-014-0828-2
14. Yuce B, Rezgui Y, An ANN-GA semantic rule-based system to reduce the gap between predicted and actual energy consumption in buildings, *IEEE Transactions on Automation Science and Engineering* , (2015) 1-13 ISSN 1545-5955 10.1109/TASE.2015.2490141
15. Zhao W, Beach T, Rezgui Y, Optimization of potable water distribution and wastewater collection networks: A systematic review and future research directions, *IEEE Transactions on Systems, Man, and Cybernetics: Systems* , (2015) ISSN 2168-2216 10.1109/TSMC.2015.2461188
16. Yuce B, Li H, Rezgui Y, Petri I, Jayan B, Yang C, Utilizing artificial neural network to predict energy consumption and thermal comfort level: an indoor swimming pool case study, *Energy and Buildings* , 80 (2014) 45-56 ISSN 0378-7788 10.1016/j.enbuild.2014.04.052
17. Yang C, Li H, Rezgui Y, Petri I, Yuce B, Chen B, Jayan B, High throughput computing based distributed genetic algorithm for building energy consumption optimization, *Energy and Buildings* , 76 (2014) 92-101 ISSN 0378-7788 10.1016/j.enbuild.2014.02.053
18. Wang B, Li H, Rezgui Y, Bradley A, Ong H, BIM based virtual environment for fire emergency evacuation, *The Scientific World Journal* , 2014 (2014) ISSN 2356-6140 10.1155/2014/589016
19. Petri I, Beach T, Rezgui Y, Wilson IE, Li H, Engaging construction stakeholders with sustainability through a knowledge harvesting platform, *Computers in Industry* , 65 (3) (2014) 449-469 ISSN 0166-3615 10.1016/j.compind.2014.01.008
20. Petri I, Li H, Rezgui Y, Chunfeng Y, Yuce B, Jayan B, A modular optimisation model for reducing energy consumption in large scale building facilities, *Renewable and Sustainable Energy Reviews* , 38 (2014) 990-1002 ISSN 1364-0321 10.1016/j.rser.2014.07.044

21. Petri I, Li H, Rezgui Y, Yang C, Yuce B, Jayan B, A HPC based cloud model for real-time energy optimisation, *Enterprise Information Systems* , (2014) ISSN 1751-7583 10.1080/17517575.2014.919053
22. Petri I, Punceva M, Rana OF, Theodorakopoulos G, Rezgui Y, A broker based consumption mechanism for social clouds, *International Journal of Cloud Computing* , 2 (1) (2014) 45-57 ISSN 2043-9989
23. Rezgui Y, Marks A, Alhajri H, Wilson I, Developing an ISDM adoption decision model using delphi and AHP, *Arabian Journal for Science and Engineering* , 39 (4) (2014) 2799-2815 ISSN 2191-4281 10.1007/s13369-013-0904-7
24. Gupta A, Cemesova A, Hopfe C, Rezgui Y, Sweet T, A conceptual framework to support solar PV simulation using an open-BIM data exchange standard, *Automation in Construction* , 37 (2014) 166-181 ISSN 0926-5805
25. Petri I, Rana OF, Silaghi GC, Rezgui Y, Risk assessment in service provider communities, *Future Generation Computer Systems* , 41 (2014) 32-43 ISSN 0167-739X 10.1016/j.future.2014.08.013
26. Manzoor U, Nefti S, Rezgui Y, Autonomous Malicious Activity Inspector – AMAI, *Lecture Notes in Computer Science* , 6177 (2014) 204-215 ISSN 0302-9743 10.1007/978-3-642-13881-2_21
27. Meesapawong P, Rezgui Y, Li H, Planning innovation orientation in public research and development organizations: Using a combined Delphi and Analytic Hierarchy Process approach, *Technological Forecasting and Social Change* , 87 (2014) 245-256 ISSN 0040-1625 10.1016/j.techfore.2013.12.023
28. Zarli A, Rezgui Y, Belziti D, Duce E, Water analytics and intelligent sensing for demand optimised management: The WISDOM vision and approach, *Procedia Engineering* , 89 (2014) 1050-1057 ISSN 1877-7058 10.1016/j.proeng.2014.11.224
29. Aldossary N, Rezgui Y, Kwan AS, Domestic energy consumption patterns in a hot and arid climate: A multiple-case study analysis, *Renewable Energy* , 62 (2014) 369-378 ISSN 0960-1481 10.1016/j.renene.2013.07.042
30. Aldossary N, Rezgui Y, Kwan AS, Domestic energy consumption patterns in a hot and humid climate: A multiple-case study analysis, *Applied Energy* , 114 (2014) 353-365 ISSN 0306-2619 10.1016/j.apenergy.2013.09.061.
31. Hazelwood T, Jefferson AD, Lark RJ, Gardner DR, Numerical simulation of the long-term behaviour of a self-healing concrete beam vs standard reinforced concrete, *Engineering Structures* , 102 (2015) 176-188 10.1016/j.engstruct.2015.07.056
32. Gardner DR, Jefferson AD, Hoffman A, Lark RJ, Simulation of the capillary flow of an autonomic healing agent in discrete cracks in cementitious materials, *Cement and Concrete Research* , 58 (2014) 35-44 ISSN 0008-8846 10.1016/j.cemconres.2014.01.005
33. Hazelwood T, Jefferson AD, Lark RJ, Gardner DR, Long-term stress relaxation behavior of predrawn poly(ethylene terephthalate), *Journal of Applied Polymer Science* , 131 (23) (2014) ISSN 0021-8995 10.1002/app.41208.
34. Mohammed Ameen RF, Mourshed M, Li H, A critical review of environmental assessment tools for sustainable urban design, *Environmental Impact Assessment Review* , 55 (2015) 110-125 ISSN 0195-9255 10.1016/j.eiar.2015.07.006
35. Lydon GP, Ingham DB, Mourshed M, Ultra clean ventilation system performance relating to airborne infections in operating theatres using CFD modelling, *Building Simulation* , 7 (3) (2014) 277-287 ISSN 1996-3599 10.1007/s12273-013-0145-4
36. Wright JA, Brownlee AE, Mourshed M, Wang M, Multi-objective optimization of cellular fenestration by an evolutionary algorithm, *Journal of Building Performance Simulation* , 7 (1) (2014) 33-51 ISSN 1940-1493 10.1080/19401493.2012.762808.
37. Edwards G, Li H, Wang B, BIM based collaborative and interactive design process using computer game engine for general end-users, *Visualization in Engineering* , 3 (2015) ISSN 2213-7459 10.1186/s40327-015-0018-2
38. Liu Y, Li H, Li H, Pauwels P, Beetz J, Recent advances on building information modeling, *The Scientific World Journal* , 2015 (2015) ISSN 2356-6140 10.1155/2015/786598
39. Wong J, Wang X, Li H, Chan G, Li H, A review of cloud-based BIM technology in the construction sector, *The Journal of Information Technology in Construction* , 19 (2014) 281-291
40. Li Z, Li H, Wang X, Li K, A generic cloud platform for engineering optimization based on OpenStack, *Advances in engineering software* , 75 (2014) 42-57 ISSN 0965-9978 10.1016/j.advengsoft.2014.05.001.
41. Kwan A, Hatem WA, Miles J, The impact of non-verbal communication on team productivity during design, *International Journal of Management (IJM)* , 5 (12) (2014) 43-68 ISSN 0976-6502
42. Shon S, Kwan AS, Lee S, Shape control of cable structures considering concurrent/sequence control, *Structural Engineering and Mechanics* , 52 (5) (2014) 919-935 ISSN 1225-4568 10.12989/sem.2014.52.5.919

1. Mourshed M, Robert S, Ranalli A, Messervey T, Reforgiato D, Contreau R, Becue A, Quinn K, Rezgui Y, Lennard Z, Smart grid futures: Perspectives on the integration of energy and ICT services, *Energy Procedia* , 75 (2015) 1132-1137 ISSN 1876-6102 10.1016/j.egypro.2015.07.531
2. Yuce B, Rezgui Y, Howell SK, ANN-genetic algorithm-based rule generation for holistic energy management in public buildings, *eWork and eBusiness in Architecture, Engineering and Construction: ECPPM 2014* , (2015) 401-408 ISBN 9781315736952 10.1201/b17396-68
3. Aldossary N, Rezgui Y, Kwan AS, Energy consumption patterns for domestic buildings in hot climates using Saudi Arabia as case study field: multiple case study analyses, *Computing in Building and Civil Engineering* (2014) , (2014) 1986-1993 ISBN 9780784413616 10.1061/9780784413616.246
4. Alreshidi E, Mourshed M, Rezgui Y, Exploring the need for a BIM governance model: UK construction practitioners' perceptions, *Computing in Civil and Building Engineering* , (2014) 151-158 ISBN 9780784413616 10.1061/9780784413616.020
5. Alreshidi E, Rezgui Y, Mourshed M, Requirements for developing BIM governance model: Practitioners' perception, 7th Saudi Students Conference in the UK , (2014) ISBN 9780956904522
6. Alyami SH, Rezgui Y, Kwan AS, The process of adapting a sustainable building assessment method worldwide: SEAM, a case study, *Computing in Civil and Building Engineering* (2014) , (2014) 1978-1985 ISBN 9780784413616 10.1061/9780784413616.245.
7. Debnath KB, Mourshed M, Chew SP, Modelling and forecasting energy demand in rural households of Bangladesh, *Energy Procedia* , 75 (2015) 2731-2737 ISSN 1876-6102 10.1016/j.egypro.2015.07.480
8. Dowd RM, Mourshed M, Low carbon buildings: Sensitivity of thermal properties of opaque envelope construction and glazing, *Energy Procedia* , 75 (2015) 1284-1289 ISSN 1876-6102 10.1016/j.egypro.2015.07.189
9. Mohammed Kadhim N, Mourshed M, Bray M, Shadow detection from very high resolution satellite image using grabcut segmentation and ratio-band algorithms, *PIA15+HRIGI15 – Joint ISPRS Conference (Volume XL-3/W2)* , XL-3/W (2015) 95-101 10.5194/isprsarchives-XL-3-W2-95-2015
10. Mourshed M, Robert S, Ranalli A, Messervey T, Reforgiato D, Contreau R, Becue A, Quinn K, Rezgui Y, Lennard Z, Smart grid futures: Perspectives on the integration of energy and ICT services, *Energy Procedia* , 75 (2015) 1132-1137 ISSN 1876-6102 10.1016/j.egypro.2015.07.531
11. Alreshidi E, Mourshed M, Rezgui Y, Exploring the need for a BIM governance model: UK construction practitioners' perceptions, *Computing in Civil and Building Engineering* , (2014) 151-158 ISBN 9780784413616 10.1061/9780784413616.020
12. Alreshidi E, Rezgui Y, Mourshed M, Requirements for developing BIM governance model: Practitioners' perception, 7th Saudi Students Conference in the UK , (2014) ISBN 9780956904522
13. Mohammed Ameen RF, Li H, Mourshed M, Sustainability assessment methods of urban design: a review, *The 21st International Workshop on Intelligent Computing in Engineering 2014 - July 16th-18th, 2014 Cardiff* , (2014) ISBN 9780993080708

Funded Research

Current active project portfolio

We have a current a portfolio of funded project of an overall budget in excess of **£3.7M** as detailed below:

Mourshed M, Rezgui Y, Cipcigan L, Rana O (COMSC)

Title: “Multi-Agent Systems and secured coupling of Telecom and Energy grids for next generation smart grid services (MAS2TERING)”

Sponsor: EC FP7

Value: £249462; Duration: 01/09/2014 - 31/08/2017

The success of the European vision of a low carbon electricity grid that minimises greenhouse gas emissions; and enhances security, quality and reliability of supply depends on how smart infrastructures, combining energy and telecom, are developed and implemented for the wider integration of security-aware distributed energy resources into the increasingly decentralised grid. MAS2TERING, a 3-year technology-driven and business-focussed project, is aimed at developing innovative information and communication technology (ICT) platform for the monitoring and optimal management of low-voltage distribution grids by integrating last mile connectivity solutions with distributed optimisation technologies, while enhancing the security of increased bi-directional communications. The project also aims at enabling new collaboration opportunities between grid operators and telecom and energy companies, both from technology and business perspectives. The project consortium includes prominent industrial organisations and research institutes from the European energy, telecom and security fields, to leverage the critical dimensions of energy, ICT, security and business. Nine project partners are CEA, Utility Partnership Limited, R2M Solution, GDF Suez, Cassidian CyberSecurity, Telecom Italia, Cardiff University, Waterford Institute of Technology and Laborelec, from five European countries: France, United Kingdom, Italy, Ireland, Belgium.

Li H, Rezgui Y

Title: “Research on key technologies of CloudBIM and energy big data processing framework for Shanghai City, P.R.China”

Sponsor: Shanghai Lubansoft Co Ltd

Value: £19753; Duration: 15/06/2014 - 14/06/2016

This is a collaboration between Shanghai and Cardiff University to develop a roadmap with a view of promoting the use of semantics in the city of Shanghai to improve day-to-day planning as well as infrastructure management .

Rezgui Y, Kwan A, Li H, Mourshed M, Beach T

Title: “WISDOM Water analytics and intelligent sensing for demand optimised management”

Sponsor: European Commission (FP7)

Value: £352687; Duration: 01/02/2014 - 31/01/2017

The WISDOM (Water analytics and Intelligent Sensing for Demand Optimised Management) project aims at developing and testing an intelligent ICT system that enables "just in time" actuation and monitoring of the water value chain from water abstraction to discharge, in order to optimise the management of water resources. The WISDOM project's unique selling point is the combined use of three key elements: the adoption of a semantic approach that captures and conceptualizes holistic water management processes, including the associated socio-technical dimensions (social networks interactions with physical systems). The adoption of semantic modeling will enable to promote: (a) the (semi)automated control of the water system operation, (b) the computer-aided decision making for human intervention, (c) the data sharing among numerous components and tools, and the integration of the water infrastructure functionalities, (d) the interfacing with other smart energy infrastructures and building systems. The WISDOM project considers a holistic view of water management systems and processes across the entire water value chain, from abstraction to discharge

Rezgui Y, Mourshed M, Li H

Title: “Portable, exhaustive, reliable, flexible and optimized approach to monitoring and evaluation of building performance PERFORMER”

Sponsor: European Commission (FP7)

Value: £459505; Duration: 02/09/2013 - 01/09/2017

The main objective of the PERFORMER project is to develop, install and finally assess energy and environmental benefits of an innovative integrated concept for the monitoring and evaluation of building energy performance, towards energy performance guarantee. The project technological objectives are: (a) devise a holistic building energy monitoring methodology that factors in appropriate energy performance

indicators, information models, and simulation tools, to achieve building energy performance targets; (b) specify and assemble a configurable prototype “Energy Instrumentation Kit” to be used to establish energy performance accounts during operation and retrofit / post-retrofit stages; (c) specify, adapt / integrate and deliver a comprehensive framework for in situ assessment of building intrinsic performance of the envelop; (d) specify and prototype a secure and PERFORMER (monitored) data storage and simulation facility that can be hosted either in-house (on a local server) or outsourced and ported on a cloud / high performance computing infrastructure.

Rezgui Y, Li H, Kwan A

Title: “Developing a real time abstraction & Discharge permitting process for catchment regulation and optimised water management (Wanda)”

Sponsor: TSB via Cambrensis

Value: £224959; Duration: 01/08/2013 - 31/07/2016

To achieve a step change in water savings we propose to apply and test an intelligent ICT system for "real time abstraction & discharge monitoring". This will create an open, scalable, marketable and user-friendly system to optimise water resource management and replace the current licensing system. An innovative "just-in time" ability will be applied to create substantial water savings, whilst also enhancing delivery on EU Water Framework Directive obligations. The project will combine real time traditional catchment data with remote sensing (collected by APEM) to provide greater spatial assessment of catchment hydrological variability. The Consortium will be led by Cambrensis. Data systems development, predictive modelling and analysis will be undertaken by Cardiff University and IBM. The practical application will be tested in catchments with farming, industrial (Tata Steel) and ecological stakeholders; and the regulatory viability developed with Environment Agency Wales.

Kwan A, Rezgui Y

Title: “Vertical axis drag marine turbine R&D - design and input only”

Sponsor: Repetitive Energy Company Ltd

Value: £4967; Duration: 01/05/2013 - 31/07/2013

The aim of the project is to develop a proof of concept marine turbine for energy generation.

Prof O Rana (COMSC), Prof Y Rezgui, Beach T

Title: “Clouds4Coordination: Cloud Based project co-ordination in the AEC Sector”

Sponsor: TSB via BRE

Value: £110000; Duration: 07/01/2013 - 31/12/2016

The objective of this project is to develop a governance model for data generated during the lifecycle of an Architecture, Engineering and Construction (AEC) project to be securely shared via a Cloud computing system. Whereas Cloud computing generally provides the ability to outsource computational and data storage capability, along with support for external application hosting, it has rarely been used to support coordination between people involved in a collaborative project, taking account of an industry specific process. The process will be based on BIM (Building Information Model) and data stored by each participant will conform to the BIM data model. The project will explore: (a) data sharing and interoperability using a multi-vendor Cloud environment; (b) process interoperability based on various stakeholders involved in the AEC project lifecycle. The outcome will be validated in real business conditions by an industry end user.

Rezgui Y, Li H

Title: “RESILIENT-Coupling Renewable, Storage and ICT'S, for low carbon intelligent energy management at district level”

Sponsor: European Commission (FP7)

Value: £527442; Duration: 01/09/2012 - 31/08/2016

The RESILIENT project aims to design, develop, install and assess the energy and environmental benefits of a new integrated concept of interconnectivity between buildings, DER, grids and other networks at a district level. The RESILIENT approach will combine different innovative technologies including smart ICT components, optimized energy generation and storage technologies, also for RES, integrated to provide real time accounts of energy demand and supply at a district level and assist in decision-making process.

Gardner D, Lark R

Title: “Materials for life (M4L): Biometric multi-scale damage immunity for construction materials”

Sponsor: Costain Ltd

Value: £53039; Duration: 01/10/2013 - 30/09/2016

Dr H Li, Prof B Lark

Title: "Infrastructure-BIM: A Contractor's Perspective of Infrastructure Information Modelling"

Sponsor: Alun Griffiths Contractors Ltd

Value: £20725; Duration: 01/07/2013 - 31/12/2016

Lark R, Gardner D, Jefferson A, Harbottle M

Title: "Materials for life (M4L): Biomimetic multi-scale damage immunity for construction materials"

Sponsor: EPSRC

Value: £1672025; Duration: 01/04/2013 - 31/03/2016

The resilience of building and civil engineering structures is typically associated with the design of individual elements such that they have sufficient capacity or potential to react in an appropriate manner to adverse events. Traditionally this has been achieved by using 'robust' design procedures that focus on defining safety factors for individual adverse events and providing redundancy. As such, construction materials are designed to meet a prescribed specification; material degradation is viewed as inevitable and mitigation necessitates expensive maintenance regimes; ~£40 billion/year is spent in the UK on repair and maintenance of existing, mainly concrete, structures and ~\$2.2 trillion/year is needed in the US to restore its infrastructure to good condition (grade B). More recently, based on a better understanding and knowledge of microbiological systems, materials that have the ability to adapt and respond to their environment have been developed. This fundamental change has the potential to facilitate the creation of a wide range of 'smart' materials and intelligent structures. This will include both autogenous and autonomic self-healing materials and adaptable, self-sensing and self-repairing structures. These materials can transform our infrastructure by embedding resilience in the components of these structures so that rather than being defined by individual events, they can evolve over their lifespan. To be truly self-healing, the material components will need to act synergistically over the range of time and length scales at which different forms of damage occur. Conglomerate materials, which comprise the majority of our infrastructure and built environment, form the focus of the proposed project. While current isolated international pockets of research activities on self-healing materials are on-going, most advances have been in other material fields and many have focused on individual techniques and hence have only provided a partial solution to the inherent multi-dimensional nature of damage specific to construction materials with limited flexibility and multi-functionality. This proposal seeks to develop a multi-faceted self-healing approach that will be applicable to a wide range of conglomerates and their respective damage mechanisms. This proposal brings together a consortium of 11 academics from the Universities of Cardiff, Bath and Cambridge with the relevant skills and experience in structural and geotechnical engineering, materials chemistry, biology and materials science to develop and test the envisioned class of materials. The proposed work leverages on ground-breaking developments in these sciences in other sectors such as the pharmaceutical, medical and polymer composite industries. The technologies that are proposed are microbiological and chemical healing at the micro- and meso-scale and crack control and prevention at the macro scale. This will be achieved through 4 work packages, three of which target the healing at the individual scales (micro/meso/macro) and the fourth which addresses the integration of the individual systems, their compatibility and methods of achieving healing of recurrent damage. This will then culminate in a number of field-trials in partnership with the project industrial collaborators to take this innovation closer to commercialization. An integral part of this project will be the knowledge transfer activities and collaboration with other research centers throughout the world. This will ensure that the research is at the forefront of the global pursuit for intelligent infrastructure and will ensure that maximum impact is achieved. One of the primary outputs of the project will be the formation and establishment of a UK Virtual Centre of Excellence in Intelligent Construction Materials that will provide a national and international platform for facilitating dialogue and collaboration to enhance the global knowledge economy.

New projects (other than listed above):

BIM4VET - Standardized Vocational Education and Training for BIM in EU - Sponsor: ERASMUS+ Strategic Partnership - Value: £79,000 – Duration: 01/09/2015 – 31/08/2017.

Building Information Modelling (BIM) is rapidly changing the way construction projects are procured, designed, built and managed all along the life-cycle of a facility. New skills are required, and the project tackles an urgent need to 1) develop a transparent and harmonized competence matrix for BIM actors across Europe, 2) standardize BIM missions and processes at EU scale, taking into account the international BIM developments already existing and 3) classify and harmonize BIM training curriculum and certification schemes. BIM4VET project aims at developing a European competence matrix for BIM actors and a BIM qualification maturity assessment method that will assess BIM actors' collective and individual competences. A decision-support system will also be developed to allow BIM actors to find

adapted training offer in the context of their needs, and of their lack of collective and individual competences, when working on a particular project. At longer term the project and its follow-up actions will contribute to enhance BIM actors' mobility in Europe and to the digital transition of the whole construction sector. The project is carried out by three institutions: Luxembourg Institute of Science and Technology (LU), Cardiff University (UK), Commissariat à l'Energie Atomique et aux Energies Alternatives (FR).

New bids:

Several proposals have been and are being submitted with a total share of **£2M for Cardiff University**.

Conference Organization

We have organized and hosted in Cardiff the 21st International Workshop on Intelligent Computing in Engineering 2014 - July 16th-18th, 2014 Cardiff, ISBN: 978-0-9930807-0-8. BRE delivered a keynote presentation through Nick Tune.



Proceedings: [The 21st International Workshop on Intelligent Computing in Engineering 2014 - July 16th-18th, 2014 Cardiff, ISBN: 978-0-9930807-0-8](#)

**The 21st International Workshop: Intelligent Computing in Engineering 2014
July 16-18, 2014 in Cardiff, The United Kingdom**

Call for papers

Towards new generation smart built environment, the **EG-ICE 2014 Cardiff workshop** will bring together international experts working in the relevant area. The workshop is intended to be a single-track, high-quality and small-scale event focusing on exchange of knowledge and ideas through intensive discussion. The workshop is particularly dedicated to the interdisciplinary research activities between computer science and engineering domain. The field of computing in engineering is traditionally limited to cover only analysis tasks, such as the determination of physical behaviour of structures. With the increasing complexity in engineering problem, the demands for smart data storage and process analysis for design, construction and management, is exponentially growing. Today's computing in engineering is increasingly implementing intelligent methods of modelling, simulation, reasoning and optimization to achieve the target of better supporting design, fabrication, construction and management of new generation smart built environment.

Sustainability

- Resilient building & infrastructure
- Building performance simulation
- Environmental assessment
- Sustainable design and construction
- Built Environment Modelling

Optimization and Decision Making

- Design space exploration
- Distributed/parallel optimization algorithm
- Optimization oriented design
- Optimization and control
- Dependency modelling

BIM, Ontologies, Advanced reasoning

- Parametric design & modeling
- Design collaboration
- Semantic modeling
- Ontological reasoning
- Spatial reasoning
- Graph algorithms
- Code compliance checking

Monitoring, Diagnostics, and Control

- Real time monitoring
- Data mining
- Active control & fault detection
- Prediction
- Smart building and infrastructure

Operation and Management

- Scheduling
- Life cycle cost and management
- Discrete-event simulation
- Traffic simulation
- Process modeling
- Virtual Manufacturing and supply chain management

Advanced Computing

- Machine learning
- Cloud and high performance computing
- Distributed computing
- Virtual and augmented reality
- Image processing
- Mobile computing
- Big data analysis



Progress of Individual BRE (Co) Funded PhD Studentships

<i>Student Name</i>	<i>BRE Funding Level</i>	<i>Progress</i>	<i>Key output</i>
Apeksha Gupta	KTP Co-funded	Completed	BIM based PV Deployment Simulator
Alexandra Cemesova	BRE fully funded	Completed	BIM-based Passivhaus design
Tala Kassim	Partly funded / TSB	Completed	BIM-based Regulatory Compliance checking environment
Toby Hazlewood	BRE fully funded	Completed	Novel Self-Healing Cementitious Composite Material System
Shaun Howell	iCase (EPSRC)	Year 3	City Systems modelling Environment
Yu Li	Cardiff Uni Part Funded	Year 1	District heating heat losses management
Corentin Kuster	iCase (EPSRC)	Year 1	District Environmental Simulator
Jonathan Reynolds	BRE fully funded	Year 1	District Energy Management in the Cloud