Dr Samir Dirar BSc (Hons), MPhil (Cantab), PhD (Cantab)

Lecturer in Structural Engineering

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About

Samir Dirar is Lecturer in Structural Engineering. His main research interests are in concrete structures, in particular the rehabilitation and strengthening of existing reinforced concrete (RC) structures with fibre-reinforced polymers (FRPs), non-linear finite element analysis of RC structures, development of design guidelines for strengthening of RC structures, and structural health monitoring.

Qualifications

- PhD in Engineering, University of Cambridge, 2010
- MPhil in Engineering, University of Cambridge, 2005
- BSc (Hons) in Civil Engineering, University of Khartoum, 2002

Biography

Samir Dirar graduated from the University of Khartoum (U. of K.) with a First Class BSc (Hons) in Civil Engineering in 2002. He spent his first year after graduation working as Graduate Engineer for a couple of private firms and assisting with teaching undergraduate students at U. of K.

In 2003, Samir joined the Department of Engineering at the University of Cambridge to study for the degree of MPhil in Engineering, thanks to a Shell Centenary Scholarship. In 2004, he was awarded an EPSRC PhD Studentship, together with a Trinity College Overseas Fees Bursary, to study the behaviour of reinforced concrete structures strengthened in shear with un-bonded pre-stressed and bonded passive carbon fibre reinforced polymer (CFRP) systems.

After the successful completion of his PhD degree, Samir joined the Civil and Computational Engineering Centre at Swansea University where he worked as Post-doctoral Research Assistant until 2010.

In 2010, Samir was appointed as Lecturer in Structural Engineering at the University of Birmingham where he is currently actively involved in both teaching and research.

Teaching

Teaching Programmes

- BEng Civil Engineering
- MEng Civil Engineering

Postgraduate supervision

- Rehabilitation and strengthening of existing reinforced concrete (RC) structures with fibre-reinforced polymers (FRPs)
- Non-linear finite element analysis of RC structures
- Development of design guidelines for strengthening of RC structures
- Structural health monitoring

Research

RESEARCH THEMES

Resilience and Sustainability of Reinforced Concrete (RC) Structures

RESEARCH ACTIVITY

Shear Strengthening of Existing RC Structures

The strength enhancement of existing RC infrastructure is an application of considerable economic and strategic importance, and of notable complexity. Samir's work represents the first time that the influence of pre-existing damage has been investigated in the context of carbon fibre reinforced polymer (CFRP) shear-strengthened RC beams, elucidating the important interactions between cracking, load sharing and the CFRP strengthening system. The effects of load history, type of shear strengthening system, beam depth and percentage of longitudinal steel reinforcement on the strengthened behaviour have also been examined. The experimental results indicated that

the contributions of the external CFRP systems to the shear force capacity can be significant and depend on most of the investigated variables.

Nonlinear Finite Element (NLFE) Analysis of RC Structures

Samir has been involved over the last 8 years in studies providing detailed analysis of the nonlinear behaviour of complex RC structural elements such as RC deep beams and FRP-strengthened RC structures. The main emphasis of his work has been on the development of NLFE predictive tools using advanced phased analyses and representative material models. The numerical investigations provided valuable insight into the constitutive models; in particular material models for the behaviour of concrete in shear, and the modelling techniques used in NLFE analysis of RC structures and highlighted their advantages and limitations.

Development of Design Guidelines for Shear Strengthening of Existing RC Structures

Samir's work in this area aims to formulate design models that can predict accurately the shear force capacity of FRP-strengthened RC members. To this end, Samir has drawn together existing design proposals, previously distinct work on modelling FRP-to-concrete bond, and his own work to produce a new design model that is explored and demonstrated to be an improvement upon current design practice. Key advances include: (i) the identification of limitations in current design practice; and (ii) the quantification of the design of externally bonded shear strengthening systems to extend the lifetime of existing RC infrastructure.

Other activities

- Graduate Member of the Institution of Civil Engineers
- Fellow of Cambridge Commonwealth Society

Publications

Journal Publications

Dirar, S., Lees, J. M., and Morley, C. T., "Precracked Reinforced Concrete T-Beams Repaired in Shear with Prestressed Carbon Fiber-Reinforced Polymer Straps," ACI Structural Journal, V. 110, No. 5, 2013, pp. 855-866.

Dirar, S., Lees, J. M., and Morley, C., "Phased Nonlinear Finite-Element Analysis of Precracked RC T-Beams Repaired in Shear with CFRP Sheets," ASCE Journal of Composites for Construction, V. 17, No. 4, 2013, pp. 476-487.

Dirar, S., Lees, J., and Morley, C., "Precracked Reinforced Concrete T-Beams Repaired in Shear with Bonded Carbon Fiber-Reinforced Polymer Sheets," ACI Structural Journal, V. 109, No. 2, 2012, pp. 215-224.

Conference Publications

Aldeka, A. B. B., Chan, A. H. C., and **Dirar, S.**, "Effects of Torsion on the Behaviour of Non-Structural Components Mounted on Irregular Reinforced Concrete Multi-Storey Buildings," Proceedings of the 4th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2013), Kos Island, Greece, 2013, 9pp.

Aldeka, A. B. B., Chan, A. H. C., and **Dirar, S.**, "Finite Element Modelling of Non-Structural Components Mounted on Irregular RC Buildings," Proceedings of the International Conference on Computational Mechanics (CM13), Durham, United Kingdom, 2013, 6pp.

Aldeka, A. B., Chan, A. H. C., and **Dirar, S.**, "Finite Element Modelling of Non-Structural Components Mounted on a Torsionally Multi-Storey Building," Proceedings of the 20th Annual Conference of the Association for Computational Mechanics in Engineering (ACME 2012), Manchester, United Kingdom, 2012, pp. 67-70.

Hassan Dirar, S., Morley, C., and Lees, J., "Effect of Effective Depth and Longitudinal Steel Ratio on the Behaviour of Pre-cracked Reinforced Concrete T-Beams Strengthened in Shear with CFRP Fabrics," Proceedings of the 8th International Symposium on Fibre Reinforced Polymer Reinforcement for Concrete Structures (FRPRCS-8), Patras, Greece, 2007, Paper 5-8, 10pp.

Hassan Dirar, S. M. O., Morley, C. T., and Lees, J. M., "Effect of Load History on the Behaviour of Reinforced Concrete Beams Retrofitted in Shear with CFRP Systems," Proceedings of the 3rd International Conference on Advanced Composites in Construction (ACIC 07), Bath, United Kingdom, 2007, pp. 292-300.

Hassan Dirar, S. M. O., Hoult, N. A., Morley, C. T., and Lees, J. M., "Shear Strengthening of Pre-cracked Reinforced Concrete Beams Using CFRP Straps," Proceedings of the 2nd fib Congress, Naples, Italy, 2006, Paper 10-70, 10pp.

Hassan Dirar, S. M. O., and Morley, C. T., "Nonlinear Finite Element Analysis of Reinforced Concrete Deep Beams," Proceedings of the 8th International Conference on Computational Plasticity Fundamentals and Applications (COMPLAS VIII), Barcelona, Spain, Part 1, 2005, pp. 209-212.

General Publications

Lees, J., Morley, C., Yang, X. S., and **Hassan Dirar, S.**, "Fibre-reinforced Polymer Strengthening of Pre-cracked Concrete Structures," Concrete, V. 39, No. 9, 2005, pp. 36-37.

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