INSTITUTE OF STRUCTURAL ENGINEERING

UNIVERSITEIT STELLENBOSCH UNIVERSITY

Division of Structural Engineering and Civil Engineering Informatics

MEng Research: Topics available in 2021

You are welcome to discuss the topics with the lecturers

Note that all prospective MEng[R] students will be required and assisted to apply for alternative sources of funding, such as NRF, Wilhelm Frank, DAAD etc., even where a bursary is available from project funds.

No	Lecturer	Preliminary title of research project	Brief description of project	Bursary		Research material expenses	Workstation and internet costs
				1st year	2nd year		
UCM1	Dr R Combrinck	Time-dependent behaviour of cracked concrete elements retrofitted with textile reinforced concrete	Textile reinforced concrete (TRC) is made of continuous mesh textiles surrounded by a cement based matrix. TRC is often used to repair cracked or damaged concrete (Both reinforced and unreinforced). The time-dependent tensile creep behaviour of TRC is still not well understood. This study will test both static and creep behaviour in tension of retrofitted concrete beams in order to ultimately determine the influence of tensile creep of TRC on its effectiveness as retrofitting material.	Subject to Research Grant Award/SANRAL funding, R80-100k Scholarship for MEng, 120k-150k for PhD	Subject to Research Grant Award/SANRAL funding, R80-100k Scholarship for MEng, 120k-150k for PhD	Covered	TBC
UCM2	Dr R Combrinck	Low shrinkage concrete	Concrete is one of the most successful materials in the world. However, its tendency to crack remains a big problem. These cracks can be structural due to mechanical loads or non-structural due to shrinkage of the concrete. Concrete shrinkage can be caused by drying, hydration, temperature variations and even carbonation. If the shrinkage is restrained, cracking occurs and the bigger the shrinkage the larger the cracks. This study should investigate various methods of reducing concrete shrinkage, and finally develop a mix with as low as possible shrinkage.	Scholarships of R60k-100k available for MEng, 120k-150k for PhD, speak to lecturer	Scholarships of R60k-100k available for MEng, 120k-150k for PhD, speak to lecturer	Covered	TBC
UCM3	Dr R Combrinck and Dr J Kruger	Crack prevention in 3D-printed concrete	3D-printed concrete has gained a lot of popularity for the construction of precast elements and even complete buildings. It does not require any formwork and can be constructed much faster than ordinary concrete. However, one aspect that has been neglected in research it its susceptibility to shrinkage and therefor cracking. This study should investigate both internal (fibres, SAP etc.) and external (curing, printing methods etc.) measures for preventing cracking in 3D-printed concrete.			Covered	TBC
UCM4	Dr R Combrinck and Ms H Fataar	Fatigue behaviour of steel and synthetic fibre reinforced concrete pavements	The construction of pavements and roads from SFRC is gaining popularity internationally and even in South Africa. Although these structures are subjected to high traffic (fatigue) loads, nearly no research has been done on the fatigue resistance of these elements. This study should conduct fatigue tests using a variety of different steel and synthetic fibres at different angles and embedment lengths.			Covered	TBC

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UCM5	Dr R Combrinck	Guidelines for the use of internal and external preventative methods for plastic cracking in concrete	The cracking of plastic concrete can result in serious and premature durability issues. However, these cracks can be prevented using externally applied preventative measures such as water curing, curing agent, sheets, shades, re-vibration and sequential placement as well as internal preventative measures such as shrinkage reducing admixtures, SAP and fibres. These measures are often ineffective due to incorrect application. This study should investigate and propose guidelines for the optimum application of these measures for preventing or minimising the cracking of plastic concrete.			Covered	TBC
UCM6	Dr W de Villiers	Simplified micro-modelling of masonry walls towards new National Building Regulation deemed-to-satisfy solutions	To assist in proposing new deemed-to-satisfy solutions for masonry walls in the National Building Regulations, single-storey masonry walls are analysed under ultimate limit state wind and seismic loading. A hollow block modelling strategy for simplified micro-modelling must be devised and implemented in DIANA and certain input parameters must be determined experimentally. The materials to be modelled include conventional concrete as well as alternative masonry materials of geopolymer, compressed stabilised earth and adobe.	Scholarships of R60k-100k available for MEng, 120k-150k for PhD, speak to lecturer	Scholarships of R60k-100k available for MEng, 120k-150k for PhD, speak to lecturer	Covered	TBC
UCM7	Dr W de Villiers	Macro-modelling of masonry walls towards new National Building Regulation deemed-to-satisfy solutions	To assist in proposing new deemed-to-satisfy solutions for masonry walls in the National Building Regulations, single- and double storey masonry walls are analysed under ultimate limit state wind and seismic loading. A hollow block modelling strategy must be devised for macro-modelling and implemented in DIANA and certain micro input parameters must be homogenised into the macro-scale. The materials to be modelled include conventional concrete as well as alternative masonry materials of geopolymer, compressed stabilised earth and adobe.			Covered	TBC
UCM8	Dr W de Villiers	Determining the thermal performance of alternative masonry walls	To assist the development of alternative masonry units, the thermal performance of alternative masonry walls must be determined, which facilitates their adherence to *SANS 10400-XA Energy Usage in Buildings* . An existing Hot Box testing facility needs to be improved, by means of a fluid dynamics analysis, and calibrated to the requirements of *ASTM C1363* . Walls constructed of concrete, geopolymer, compressed stabilised earth and adobe blocks, need to be subsequently tested.			Covered	TBC

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UCM9	Dr AJ Babafemi	Hydration kinetics and pozzolanic reactivity of South African sugarcane bagasse ash (SCBA) in cement-based materials	There exist conventional supplementary cementitious materials such as fly ash and silica fume in the global market. Other alternatives such as SCBA, which impacts negatively on the environment, is yet to be fully explored in South Africa. SCBA is obtainable from the co-generation boilers fed with sugarcane bagasse of the sugar industry. This process introduces unsuitable contaminations such as carbon, crystalline quartz and cristobalite. The first step towards realising the goal is to experimentally evaluate the hydration kinetics and pozzolanic reactivity of the obtainable SCBA waste and procedure for enhancing these.	Scholarships of R60k-100k available for MEng, 120k-150k for PhD, speak to lecturer	Scholarships of R60k-100k available for MEng, 120k-150k for PhD, speak to lecturer	Covered	TBC
UCM10	Dr AJ Babafemi	Fresh and mechanical properties of sustainable South African SCBA in cement-based materials	This study will entail the optimised use of South African SCBA in cement-based materials and the performance thereof. How the SCBA influences the rheological and mechanical properties will be evaluated. The goal will be to use as much SCBA as possible without detrimental effects on the interested properties.			Covered	TBC
UCM11	Dr AJ Babafemi	Durability performance of cement-based materials containing South African SCBA	The emphasis of this study will be to evaluate the microstructural properties of cement-based materials containing SCBA. Alongside, the durability performance of these cement-based materials will be evaluated. The goal is to evaluate the influence of the SCBA on the microstructure and durability with the ability to correlate both. An attempt should also be made to predict the durability performance from the microstructural analysis.			Covered	TBC
UCM12	Dr AJ Babafemi	Effect of nanoparticles on the mechanical and durability properties of concrete	The mechanical strength of cementitious composite is related to the hydration process of binders. However, hydration may not occur in all binder due to lack of sufficient moisture required for chemical reaction during hydration process. Therefore, lot of binder particles in cementitious composites remain unhydrated. Research results on nanomaterials have indicated that the addition of some nanoparticles with binders may contribute to a secondary reactions and help to further hydration in the unhydrated binder particles. This further hydration can significantly improve the mechanical properties of cementitious materials with large binder content.			Covered	TBC