

QUB PhD Project Proposal

2018-2019

Title: Bioinspired design systems	
Project Description: <p>The creation of new products sits at the heart of the economic engine driving society forward and creating the modern world as we now see it. Mass production of consumer products (such as iPhones & white goods) and the development of complex systems (such as aircraft), have become common, with a corresponding need for better design systems to ensure continued innovation and improvement.</p> <p>A key problem with current design systems is that they are top down, meaning so-called innovations are often merely perturbations on existing solutions. It is difficult to introduce, or take advantage of, new technologies and processes (e.g. additive manufacturing and composites) as they may require a product revolution, rather than evolution, to succeed. One of the great challenges facing systems engineers is the control of the demon 'emergent behaviour', which is inherently unpredictable and can result in failure to meet requirements. The result is a reliable, consistent approach, but one which limits the very innovation needed, and which strives to avoid one of the best tools for innovation: emergence.</p> <p>One way to avoid predicated solutions is to remove constraints and allow the design to emerge and grow to meet the requirements within a given environment. In the same way trees grow in response to stimuli, shape and size are not forced, rather they follow a set of elementary rules in deciding when a cell splits to grow, for example a root, branch or leaf.</p> <p>The purpose of this PhD, which will run within a wider initiative "Biohaviour" is to investigate and capture the rules (Growth Rules) which will govern how engineering structures grow. This will involve looking to nature for inspiration, theorising and capturing the rules relating to structural and heat transfer systems. Of particular interest will be how these growth rules can account for different "Stimuli" e.g. gravity, loads, temperature or are influenced by the "Environment". Ultimately, the PhD will look to develop software utilities to realise designs resulting from the captured growth rules.</p> <p>The PhD will be completed within a highly dynamic and industry focused research group which includes established academic staff, post-doctoral researchers and PhD students. Industrial partners on the project (Deloitte, Airbus, GlenDimplex and ITI) will be engaged throughout, providing industrial test cases and context.</p>	
Key Skills Required for the post: <p>Applicants should have or expect to obtain a first or upper second class honours degree, or equivalent, in Mechanical or Aerospace Engineering (or similarly appropriate) degree.</p>	
Key Transferable Skills that will be developed during the PhD: <ul style="list-style-type: none">• Knowledge and experience in developing design and analysis tools• Programming skills, from concept through to implementation• Creativity, communication and high-level industrial networks	
First/Lead Supervisor and their contact details	Prof Mark Price (m.price@qub.ac.uk)
Second Supervisor and their contact details:	Dr Declan Nolan (d.nolan@qub.ac.uk), Dr Wei Zhang
Top up available for this project?	The studentship covers the full university fees and includes an income of up to £18,500 per annum (This includes a top-up to the basic stipend which will only be awarded on the recommendation of the interview panel).