Project proposal template
Graduate School studentships
March 2015

Project title	Characterisation and design of anti-icing system using multi-layer nanopaper
First Supervisor	Professor — Jian Wang
Second Supervisor	Dr Sing Lo
School	Aerospace and Aircraft Engineering
Other member of supervisory team (no more than three KU supervisors in total)	Professor Tao Zhang and Professor Jinsong Leng (Visiting Professor at Kingston, work in China
Specific requirements beyond 2:1 degree	1st or 2:1 plus MSc

Project summary

(max 4,000 characters)

Ice accretion on the wing and nacelle leading edges diminishes aerodynamic performance and increases fuel consumption and chances of aircraft crash. For these reasons, the Federal Aviation Administration mandates aircraft manufacturers to demonstrate that their aircraft can fly safely in icing conditions. With the advent of the composite material, more and more load bearing components are made from composite materials, which leads to great difficulties for traditional bleed hot air system. High temperature and high-pressure air would cause serious problem for composite structures. Therefore, many other de-icing and anti-icing systems have been developed, such as, pneumatic inflatable boots, Electro Impulse De-icing, Electro Magnetic Expulsion De -icing, the electric thermal heaters and so on. There are some drawbacks of these systems. For example, those systems could be too heavy, and/or those system would weaken the integrity of composite structures/components.

Fortunately, the newly developed nanopaer (A meso/macropore carbon nanotube paper) by Professor Jinsong Leng's group shed a light on future anti-icing system. The nanopaper could be designed to have desired electric conductivities and electric heating performance. Multi-layer nanopaper could be designed and constructed as future anti-icing system by combing heat generator, electric meshes and electric-magnetic field generator. In addition, the nanopaer would provide desired anti-lightning performance.

The proposed project is aimed at investigating the feasibility of anti-icing characteristics of multi-layer nanopaper. The objectives are as follows:

- Critical literature review on current anti icing systems and the systems underdevelopment
- Understanding anti-icing mechanisms of electric/electric-magnetic system
- Characterizing one of the three issues: electric conductivities, electric heating performance, and electric-magnetic capabilities of nanopaper through numerical modelling, and validated by experimental measurements
- Based on current and future anti-icing requirements and characteristics of nanopaper, proposing different designs/configrations of multi-layer nanopaper anti-icing systems
- Numeric and experimental validation of the systems.

The suitable candidate should have engineering background. Knowledge of heat transfer, CFD and numerical skills will be desirable.

Supervisor team: Professor Jian Wang, Dr Sing Lo Professor Tao Zhang and Professor Jinsong Leng (visiting professor at Kingston and the Director of the Centre for Smart Materials and Structures (CSMS) at School of Astronautics of Harbin Institute of Technology, China)