Newcastle University PhD Studentship award

**Title**
Machining of nanocomposite biomaterials: Experimental and multiscale modelling study

**Value of award**
100% of International tuition fees paid

**Number of awards**
1

**Start date and duration**
September 2019 for 3 years

**Application closing date**
8th February 2019

**Overview**
Metal matrix composites (MMC) with nano reinforced particles are gaining in popularity in biomedical, automotive, aerospace, and sports applications. The conventional machining processes are used to manufacture the MMC-based products, whose performance is highly sensitive to the surface finish. The enhanced mechanical properties of MMCs and tool-like hardness of reinforced particles bring additional challenges to machining processes. The deteriorative machined surface finish and excessive tool wear have been recognised as the main obstacles during machining of MMCs due to their heterogeneous and abrasive nature. Currently, there is very little literature available on the machining of nano-MMCs. The cutting mechanics and machined surface generation are yet to be understood. There are a few attempts in modelling cutting process of MMCs, however, in these known models the interface between the reinforced particles and matrix materials has been simplified, e.g. using either a cohesive element layer representation or shared nodes method, both methods cannot accurately describe the interfacial properties and material deformation/failures.

This project aims to investigate the micro cutting mechanics and surface generation of nano-MMCs using both experimental and multiscale modelling approaches. A novel multiscale modelling approach for nano-MMCs by incorporating phase-field approach and finite element (FE) modelling will be explored to accurately describe the interfacial properties. The simulation results together with comprehensive micro machining tests will provide insight into the cutting mechanics and machinability of such materials.

The PhD student will work on cutting edge research on machining science and material modelling. They will develop a range of practical, analytical and modelling skills on micro-machining experiment design, numerical modelling, and surface characterisation. This project has the potential to have a high impact on wide industrial applications of nano-MMCs.

**Further project details**

**Sponsor**
Faculty of Science Agriculture and Engineering and Chinese Scholarship Council (CSC)

**Name of supervisor(s)**
Eligibility Criteria
You must be a citizen and permanent resident of the People’s Republic of China at the time of application.

Candidates should have 1st Class or 2.I degree with follow up MSc, in mechanical engineering, materials science, or similar subjects with strong mathematical/materials grounding. Experience in finite element modelling and C/Python/Matlab programming would be an advantage.

How to apply
You must apply through the University’s online postgraduate application system. Apply here. To do this please ‘Create a new account’. All relevant fields marked with a red asterisk must to be completed.

The following information will help us to process your application. You will need to:
• Insert the programme code 8090F in the programme of study section
• Select PhD Mechanical Engineering (full time) - Mechanical and Systems Engineering as the programme of study
• Insert the studentship code CSC1805 in the studentship/partnership reference field
• Attach a covering letter and CV. The covering letter must state the title of the studentship, quote reference code CSC1805 and state how your interests and experience relate to the project
• Attach degree transcripts and certificates and, if English is not your first language, a copy of your English language qualifications

Contact
For further information please email either dehong.huo@newcastle.ac.uk or Hemanth.Yeddu@newcastle.ac.uk