**Research Grants for PhD students from the China Scholarship Council**  
**Information Form (please read the guidelines carefully on the website www-csc.utt.fr)**

**Supervisor's name:** GRATTON  
**Given names:** MICHEL

**Status (prof., assistant prof., ...):** Associate professor

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<thead>
<tr>
<th>Laboratory</th>
<th>Website address</th>
</tr>
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<tbody>
<tr>
<td>Laboratory of Mechanics and Rheology</td>
<td><a href="http://www.lmr.univ-tours.fr">www.lmr.univ-tours.fr</a></td>
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<tr>
<td>INSA Centre Val de Loire</td>
<td><a href="http://www.insa-centrevaldeloire.fr">www.insa-centrevaldeloire.fr</a></td>
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**Scientific competence of the supervisor:**  
Dr GRATTON Michel received his PhD degree in 1997 in mechanical engineering from LMT Cachan, France. Since 1998, he is Associate professor at INSA Centre Val de Loire at Blois, France and member of the Rheology and Mechanical Laboratory (LMR), Francois Rabelais University, Tours, France. His research interests include experimental mechanics, mechanical characterization of anisotropic materials, composites fibers reinforced carbon dynamic behaviour, oligocyclic fatigue.

**Title:** Characterisation of vibratory and classical fatigue for a new unified model

**Subject:**  
Fatigue effects due to ambient vibrations of long duration are the main causes of structural failures. Structural manufacturers are very much concerned with vibration testing of structure prototypes in order to determine if they can support the vibration environment expected during their lifetime without being damaged. Up to now, qualification tests are performed according to different standards. These standards do not have the same severity so that the choice of one standard rather than another is not obvious. The objective of this research project is to propose a new methodology to identify and develop one or more criteria according with the correlation between vibration and fatigue solicitations in order to quantify the severity of different vibration environments. To this end, specimens will be designed to optimize the geometry, different severity criteria will be first defined. The corresponding bench tests on specimens with strain gauges, laser vibrometry and digital images correlation will be performed. Based on these criteria, effects of vibratory excitations will be estimated and compared. A anisotropic modelling of fatigue could be investigated on metallic and/or composite materials. The final behaviour will be identified and implemented in Abaqus Standard as a UMAT format. Comparisons between experimental results and finite elements computations conclude the thesis.

**Keywords:** Fatigue, environmental tests, experimental mechanics, damage, phenomenologic behaviour, user subroutine, Abaqus, finite elements analysis

**Expected collaborations:**  
The objective of this project is to initiate collaborations with chinese or international researchers working on related topics in order to develop and share the knowledge on this topic. The local team will bring competences with non-european students for many years and will ensure a blooming the PhD student through extracurricular activities like cultural or sport activities (golf, 1 skiing week/year, Tennis,..) and the participation to the high level scientific congress (HPSM, Fatigue Design, WCCM). Blois is a small but marvelous historical city in the UNESCO Loire valley.

**Background required from the applicant:**  
After a top Master graduation in mechanical engineering where the applicant developped excellent skills on experimental mechanics, engineering science, computational methods, finite elements analysis, we are looking for an applicant which has a goal to excel and live up the expectations in performing the project assigned. The applicant should have a great motivation about the field of the thesis and a strong determination to push down scientific limits. The applicant will be invited to become part of a team.

**Existence of a PDF file detailing the proposal ("yes" or "no"):** no
  
(see guidelines on the website www-csc.utt.fr)