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# RECENT ADVANCES in APPLIED and THEORETICAL MECHANICS



Proceedings of the 4th WSEAS International Conference on  
APPLIED and THEORETICAL MECHANICS (MECHANICS '08)

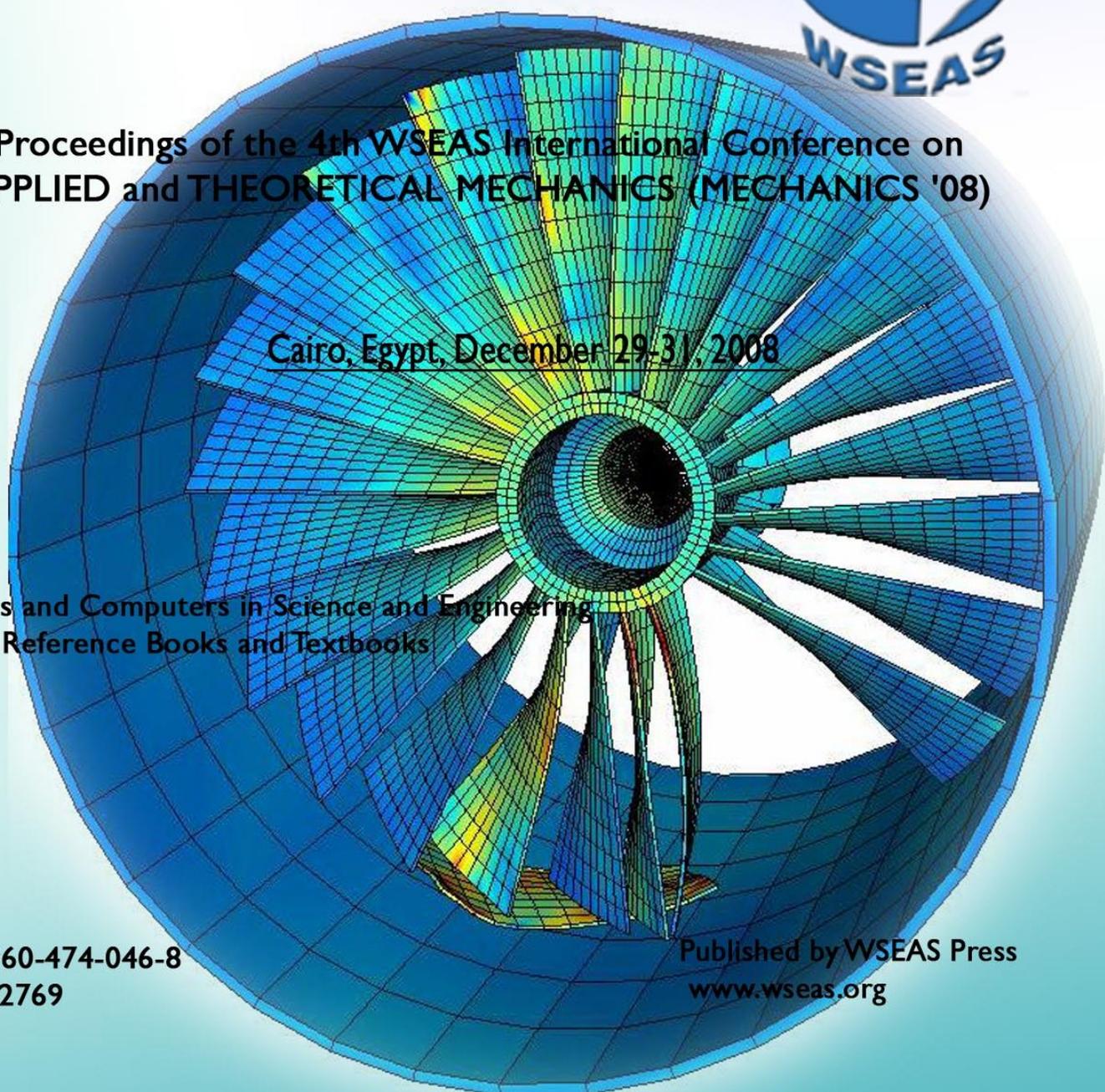
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## **Preface**

This book contains most of the papers presented at the conference on APPLIED and THEORETICAL MECHANICS (MECHANICS '08) held in Cairo, Egypt, December 29-31, 2008.

The conference provides a platform to discuss the theory and applications of mechanics.

In the last few years the focus has been on topics such as manufacturing processes, mechanics of nanomaterials, geomechanics and mechanics of granular materials, advanced materials and smart structures, micro electromechanically systems (MEMS), mechatronics etc.

This important 3 days multiconference offered to the colleagues 2 banquets (60 different courses -self-service buffet-, live music and live dances with more than 30 dancers and 18 folklore appearances) and one great excursion, (WSEAS offered free buses for the conference excursions and the English speaking tour guide for free. Dec, 31, 2008: Tour in Cairo (Pyramids of Giza, Sun Boat, Sphinx, Papyrus museum, Bazaar), Memphis and Sakkara (Stepped pyramid of Sakkara, Tombs of Nobles, Tombs of ministers, Memphis museum, TiTi pyramid). The 2 banquets were superb and they included oriental dance in 18 different appearances: <http://www.wseas.us/reports/2008/cairo/index.html> as well as Sofi dance and many Egyptian singers.

After the excursion of 31/12/2008, we continued with the Session/Symposium: E-Learning with 18 important papers. The International Scientific Committee met during the Conference in a Cairo restaurant well known for the standards of its cuisine and its friendly atmosphere.

Ways to improve the Conference were discussed over dinner: in particular the topics were revised and new ones were suggested. In addition, a few nominations for new committee members were proposed. Following the meeting, the decision was taken to relocate the Conference, and a few locations were suggested.

The WSEAS Conference Division will investigate these so that the dates and location of 2010 are finalized as soon as possible.

Each paper was reviewed at least by 3 independent reviewers. The WSEAS Secretariat sent each paper to 5 reviewers. Some papers received reviews from 5 different referees. The WSEAS Secretariat forwarded these comments by personalized emails to the responsible for the correspondence author. The full list of the reviewers will be available in the web page: <http://www.worldses.org/reviewers.htm>

The best papers of this multiconference are available now

<http://www.wseas.us/reports/2008/best2008.htm#december2008b>

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The Editors



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## Plenary Lecture

### Wavelet Based Fatigue Data Editing: Application for Accelerated Fatigue Tests of Steel Specimens under Spectrum Loadings



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**Abstract:** Many experimental loadings measured on both roads and test tracks generate variable amplitude (VA) load time histories contain transient or high amplitude. The presence of large amplitude cycles is common in time histories of ground vehicle vibration and fatigue damage. When a vehicle is moving over the irregular road surface, high amplitude features (or bump segments) can be observed in the time histories. Therefore, the need to reduce development time and improving confidence in the fatigue road load analysis means that it is an interest to investigate the issue of fatigue loading compression. This method, which is known as fatigue data editing, is used to produce a shortened loading containing large amplitude cycles. Accelerated fatigue tests can then be performed in the laboratory using these loadings, which has shorter time length and equivalent fatigue damage potential when compared to the original loading. Without editing VA loadings, the testing time and cost become prohibitive. Hence, this work describes the accelerated fatigue tests of BS 080A42 steel specimens using shortened VA loadings. Practically, a VA strain loading which was measured on the lower suspension arm of a vehicle while driven over a pave road surface was used. This loading was summarised using Wavelet Bump Extraction (WBE), for which WBE was developed based on the idea of bump identification and extraction in order to produce a shortened loading using the orthogonal wavelet transform approach. The aim of this study is to demonstrate the applicability of the WBE mission loadings for laboratory accelerated fatigue tests using notched specimens. The WBE shortened loading was also validated based on the fatigue life comparison to the original loading using four strain-life fatigue damage models. Experimental fatigue tests were performed using a cylindrical shape of notched specimens made from the BS 080A42 steel. The experimental findings showed that the fatigue tests were accelerated from 99 hours to 36 hours, and 78.8 hours to 32.5 hours for smooth and notched specimens, respectively. The results indicate that the WBE algorithm gave an alternative solution for the accelerated fatigue tests, particularly in the durability and automotive research.

**Brief Biography of the Speaker:** Dr. Shahrum Abdullah is the lecturer in Department of Mechanical and Materials Engineering, Universiti Kebangsaan Malaysia. He obtained his first degree in Mechanical Engineering at Universiti Kebangsaan Malaysia in 1995. In 1997, he obtained his MSc (Engineering Design) degree from Loughborough University of United Kingdom. In 2005, Finally, he was awarded the Ph.D. degree in Mechanical Engineering at the University of Sheffield, United Kingdom. His PhD thesis is within the scope of fatigue data analysis using the signal processing method, particularly the wavelet transform, which are the core research activities in his current days. Dr. Shahrum Abdullah authored many papers related to his specialization (engineering design and fatigue life assessment) in many international journals and proceedings.

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