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Guest Editorial

Mechanisms and machines using multiple impacts for processing and demolition have been studied and widely used in engineering due to massive reconstruction after the World War II. The functioning of such systems was based on the use of strongly nonlinear dynamic processes. That period of time coincided with an increased interest in nonlinear dynamics boosted by developments of radio physics, automatic control, supersonic aviation and space exploration. Interactions between those trends gradually brought about the formation of the general theory of vibro-impact systems as an important area of nonlinear dynamics.

Vibro-impact interactions are the most intensive sources of mechanical influence on materials, structures and processes. They can produce both vividly beneficial and detrimental effects, the latter sometimes looking like mysterious catastrophes.

The increased demands for the speed, reliability and accuracy of various systems and processes as well as environmental protection lead to a deeper penetration into the nature of vibro-impact processes with developments of new models and analysing techniques. Nowadays these studies are most advanced in mechanics of materials, machine dynamics, vibration engineering, and structural mechanics.

Research of vibro-impact systems covers not only traditional applications of percussion technologies used for penetration, crushing, compacting, tightening, piling, etc. This also includes analysis of the behaviour of materials and structures in harsh environment, micromechanics of deformation and fracture, testing, sloshing, machining of intractable materials, processing of granular media and other intensive dynamic processes with frequencies ranging from sub-Hertz to ultrasonic.

Research methodologies used include analysis of nonlinear differential equations, numerical simulations of dynamic behaviours of complex nonlinear structures and media, experimentation in extreme loading and environmental conditions and high-precision contactless metrology.

Loughborough University, UK leads intensive research into various applications of vibro-impact dynamic processes for development of advanced technologies. In order to expand research and development of vibro-impact systems within the EU and worldwide, Loughborough University initiated organisation of the International Centre of Vibro-Impact Systems (ICoVIS).

The main aims of the ICoVIS are:

- providing a forum for and building collaboration between industry and academia from different countries;
- providing a source of expertise on vibro-impact systems and processes;
- developing world-class technologies;
- promoting collaborative research;
- organising international meetings on the subject.

The Scientific Committee of the Centre currently includes the leading researchers from Germany, Israel, Japan, PR China, Russia, UK and USA.

The first International Conference on Vibro-Impact Systems was organised by the ICoVIS with support of the Engineering and Physical Sciences Research Council (EPSRC) UK, Stress and Vibration Group of the Institute of Physics, UK and the Japan Society of Mechanical Engineers. It took place at Loughborough University on 20–22 July 2006. More than 70 papers were presented by researchers from 20 countries. They covered many aspects of dynamics of vibro-impact systems and multiple exciting applications. The Conference

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confirmed that vibro-impact systems are among the most challenging objects of nonlinear dynamics with a great potential impact on engineering.

The invited papers in this Special Issue were selected after an international peer review of the conference papers and following authors' revisions. They comprise many topics discussed during the conference. For convenience of the readers we grouped the papers on similar topics into sections.

Finally, the Guest Editors would like to express their gratitude to all the conference sponsors mentioned and Ms Marina Tourichtcheva, ICoVIS Administrator for her help in preparation of this Special Issue.

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