MEETING REPORT

Digital imaging and computed tomography*

Since the development of the first system in the early 1970s by Godfrey Hounsfield and Allan McCormack and its usage in biomedical sciences at the Atkinson Morley's Hospital, London, UK, computed tomography (CT) imaging technique has been redesigned several times. However, the basic principle has remained the same with X-rays used for creating two-dimensional (2D) and three-dimensional (3D) images (digital cross-sections/slices) of a physical object taking into account the density differences within the object under study. In terms of its application, CT technology has been variously used in the field of metallurgy and biomedical sciences. Moreover, in the last decade, the technology has seen its utilization in the field of geology and allied sciences (e.g. vertebrate palaeontology) and in the study of extant (living) flora and fauna.

To highlight the recent advances in the field of digital imaging with a focus on micro-computed tomography (μ-CT), a two day workshop was held in November 2016.

The workshop had a diverse audience from industry, academic institutions and research and development (R&D) organizations from India and abroad.

It covered a total of nine oral presentations, a group discussion and two practical sessions. On the first day a single session was held that covered five presentations (invited talks/oral presentations), while on the second day, a single session covered four presentations (invited talks/oral presentations); a group discussion was held later. The practical sessions provided training to delegates on various aspects of digital imaging (2D) and μ-CT 3D imaging.

The workshop began with an introduction by Suneil Rajagopal (General Electric (GE), India and South Asia) on the new technologies that GE has developed in recent years to cater to the needs of industry and R&D organizations. Subsequently, Steven Wessels (GE, Oil and Gas, Belgium) discussed the history of the development of the techniques of digital radiography (DR) and computed radiography (CR), and their utility in the oil and gas industry. This was aptly followed by Guido Erbach's (GE, Oil and Gas, Germany) talk on the basic techniques involved in CT, in which the concept of voxels (three-dimensional space) was introduced and discussed in detail. Samaresh Changdar (GE Digital Solutions, India) discussed the development and utilization of cloud-computing technologies (interlinked to digital imaging techniques) in the industries, while stressing the need for faster data analysis and inferences. Edward Stanley (Florida Museum of Natural History, USA) presented a talk on the application of μ-CT in the field of biomedical and biological research, emphasizing on recent work carried out on extant anurans (frogs) and squamates (lizards). In a separate presentation, Erbach discussed advantage(s) and limitation(s) of state-of-the-art additive manufacturing (AM) technology, popularly known as '3D-printing' in material, biomedical, biological and geological sciences. He also discussed the uses of CT imaging in metrology in the industry (automotive, aviation, defence, and oil and gas). Vivesh V. Kapur (BSIP, Lucknow) presented a glimpse of his ongoing research (incorporating μ-CT imaging technique) on the Late Cretaceous to Palaeogene vertebrate fossils from the Indian subcontinent. Use of this non-destructive technique has certainly led to an enhancement in taxonomic inferences that may help deduce (in detail) the palaeobiographic scenarios close to the India–Asia collision phase, which has so far been demonstrated by only a few researchers across the world. Kapur also emphasized on using non-destructive μ-CT technology for digital archiving of museum collections (e.g. artifacts, fossils and biological specimens) across India. The Health, Safety and Environmental (HSE) norms and mandatory certification(s) required for installation(s) and operation(s) of equipment(s) that utilize radioactive materials were discussed in detail by Vikash Behari (GE Digital Solutions, India).

Practical sessions organized during the workshop provided hands-on experience to the participants in conducting μ-CT analysis using Pheonix|X-ray v|tome|xs CT scanner and 3D reconstructions using VG studio and datos|x reconstruction software. A group discussion on the second day of the workshop attested the need for using non-destructive technique (μ-CT) for the study of materials in the industry, fossil and biological specimens. It was also highlighted that data-sharing among the scientific community (e.g. Morphobank) through digitization of museum collections (artifacts, fossils and biological specimens) will be a radical step in the science of the near future.

Overall, the workshop provided an exceptional opportunity to engineers, scientists, academicians and research scholars to discuss and debate the future scope and utilization of μ-CT in the field of engineering, materials science, biological science and palaeoscience. It is expected that μ-CT imaging technique will help in (i) reduction of production time and costs in the industry (automotive, aviation, oil and gas and others), (ii) data sharing among the scientific community across the globe, and (iii) increasing the social reach/appeal of research in palaeosciences and allied fields, in the near future.

*A report on the two-day workshop on 'Digital Imaging and Computed Tomography' organized by General Electric at its Application Solution Centre in Pune during 17 and 18 November 2016.

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