



Editorial

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Design is an age-old creative activity of human civilization, which is a blend of science and art. Often the designer uses his/her intuitive feelings to arrive at a solution. Depending on the competency of designer and the circumstances, the obtained solution may be optimal or sub-optimal. There have been major incidents, when product failed to serve the intended purpose and caused disaster. The failure of Titanic ship in 1912 is one such example. It occurred due to underestimation of fracture strength in the cold environment. On the other hand, there are a plethora of examples, where the design is over safe and consequently the resources are wasted. This is unacceptable for the sustainable development in the modern times. Hence, it is necessary that each design solution is properly analyzed and finally an optimal design is selected. This fact is getting recognition among engineers and thumb rule practices are getting replaced by sophisticated analytical tools using high speed computers.

Last year, a conference entitled *Recent Advancements in Mechanical Engineering* was held at North Eastern Regional Institute of Science and Technology, Nirjuli, Arunachal Pradesh, India during November 8–9, 2013. In this conference, a number of papers were presented on the analysis and optimization of mechanical systems. In order to give wider visibility to the ideas and findings of the authors of the conference, it was decided to publish revised and enhanced version of selected papers in a special issue.

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It was also decided to open the submission of the papers in relevant area to other researchers as well. The response of the authors was overwhelming and a large number of papers were received from the different fields of mechanical and aerospace engineering. All the papers were subjected to rigorous review process. Authors revised the papers as per the comments of the reviewers and the revised papers were further reviewed before taking a final decision. Finally, total 21 papers were found suitable for the special issue. Out of these, 11 papers are included in this *Special Issue* entitled **Design: Analysis and Optimization**. All these papers pertain to solid mechanics area. The next issue will contain other 10 papers, in which most of the papers are from production area, but the heat transfer and fluid mechanics area are also represented. Considering its content, the next issue has been named as *Modeling and Optimization in Design and Manufacturing*.

In this issue, the first paper shows an application of hybrid genetic algorithm for designing compliant mechanisms. Here, the compliant mechanism is in the form of an elastic structure that can deform in the desired way. Authors have used two objectives—minimization of the weight and minimization of energy requirement. The behavior of the mechanism is predicted by finite element method (FEM) and modified NSGA-II algorithm was used for optimization. The second paper presents transient ball bearing fault simulation by FEM. A computer aided design (CAD) model of a ball bearing with a minor crack in outer race was created. The FEM results were validated with experimental results. The third paper describes the contact analysis of wheel-rail system by Hertz's method and FEM. It is shown that for many situations the Hertz's method is not appropriate and FEM needs to be employed. Results obtained from the contact analysis are used to calculate fatigue damage parameter and number of cycles to failure.

The analysis may be helpful for optimizing the wheel and rail profile.

Fourth paper analyzes a two degree-of-freedom wrist joint utilizing McKibben pneumatic artificial muscles. A mathematical model of wrist joint is derived using forward kinematic analysis. Authors also carried out preliminary experiments for identifying the stiffness and damping characteristics. A control strategy is also proposed. In the fifth paper, the shape optimization of revolute jointed double link manipulator is presented. One link is considered rigid, whilst the other link is flexible. The analysis is carried out by FEM and optimization is carried out using sequential quadratic programming.

In the sixth paper, static analysis of transversely loaded isotropic and orthotropic plates with central cutout is presented. Circular and square cutouts are considered and analysis is carried out with the help of FEM. In the seventh paper, free vibration and sound power radiation response of a simply supported rectangular plate with attached discrete masses and discrete patches is analyzed using FEM. Such type of plates find application in building structures, bridges and ship decks. The analysis may help in the optimum placement of discrete masses/patches.

The eighth paper presents a methodology for estimating the extent of damage zone imparted to the composite plate by ballistic impact by using C-scans. The modified DIV-FRP algorithm showed good performance. Ninth and tenth papers are from tribology area, where characteristics of bearing under micro polar lubrication are analyzed. Ninth paper analyzes static characteristics of conical hydrostatic journal bearing and tenth paper analyzes short journal bearings. The last paper presents optimization of pressure vessels filled with pressurized hot fluids, due to which elasto-thermal stresses are generated. It is observed that increasing the wall thickness beyond a limit increases the thermal stresses and hence the optimization is very much needed. In this paper, both single objective problem of cost minimization and bi-objective problem of cost as well as the maximum shear stress minimization are tackled.

We hope that these papers will stimulate researchers to carry out the further research. At the same time, practicing engineers may like to apply some of the findings presented in this issue to solve the field problems. We are grateful to Prof Gautam Biswas, Editor-in-Chief of the Journal and Springer for providing us the opportunity to guest-edit this issue. The timely publication of the issue could happen due to the support of The Institution of Engineers (India).

U.S. Dixit obtained Bachelor's Degree in Mechanical Engineering from erstwhile University of Roorkee (now Indian Institute of Technology, Roorkee) in the year 1987, M.Tech in Mechanical Engineering in 1993 and Ph.D in Mechanical Engineering in 1998 from Indian Institute of Technology, Kanpur respectively. He has worked in two industries – HMT, Pinjore, India and INDOMAG Steel Technology, New Delhi, where his main responsibility was to design various machines. Dr. Dixit joined the Department of Mechanical Engineering, Indian Institute of Technology, Guwahati, India in the year 1998 where he is currently a Professor. He is also the Officiating Director of Central Institute of Technology, Kokrajhar, India. He is actively engaged in carrying out research in applied plasticity for the last 23 years. Dr. Dixit has published about 55 Journal papers, 50 Conference papers and three books related to manufacturing and finite element method. He has also edited one book on metal forming. He has guest-edited a number of special issues of journals in international / national repute.

Amitava De has completed his Bachelors' of Engineering in Mechanical Engineering from the erstwhile Bengal Engineering Collage, Shibpur, India (now Indian Institute of Engineering Science and Technology) in the year 1989, M.Tech in Production Science & Technology in 1991 and Ph.D on "*Numerical Modeling of Resistance Spot Welding Process and its Experimental Validation*" in 1995 from Indian Institute of Technology, Kharagpur. Later, he has worked at the Institute of Joining and Coating Technology, Technical University, Berlin, Germany for two years as a Post-doctorate long-term scholar under DAAD fellowship. In the year 1998, he has joined the Department of Mechanical Engineering, Indian Institute of Technology Bombay, Mumbai as a Faculty Member. His primary area of research is fundamental understanding of welding and material deposition processes through process modeling and experimental investigations. He has published several papers in the International and National Journals, and delivered several Keynote / Invited lectures. Currently, he is serving as Member in the Editorial Board of the "*International Journal on Science and Technology of Welding and Joining*". He is also the reviewers for several other International and National Journals in the area of manufacturing processes and simulation. He has contributed a Chapter on "*Coupled Thermo-electrical-mechanical Modeling in Fusion Welding*" for the ASM Handbook on welding and a Chapter on "*Computational Modeling of Conduction Mode Laser Welding Process*" for a Book on 'Laser Welding'. Till date, he has completed around 15 sponsored research projects, which are funded by Government agencies such as, DST, DMRL, NMRL and BRNS. Dr. De has also completed several International collaborative research projects with Cambridge University, UK, Technical University, Berlin and Pennsylvania State University, USA. He is also serving in several technical and examination committees as a life member of the Indian Institute of Welding and as a regular member of Bureau of Indian Standard (BIS).