Editorial

R. Venkata Rao

S.V. National Institute of Technology,
Ichchanath, Surat, Gujarat – 395 007, India
Fax: 91-261-2201571
E-mail: ravipudirao@gmail.com

Mechanical engineering is one of the oldest, broadest and well-established engineering disciplines. The discipline is also constantly changing and evolving in response to new scientific discoveries and societal needs. The global technological changes are forcing the mechanical engineering fraternity to resort to innovative ideas and methods in the areas of computer aided engineering, design, robotics and automation, computational techniques, instrumentation technology, materials development and advanced manufacturing methods. Keeping in view of these advances, an *International Conference on Advances in Mechanical Engineering (ICAME)* was conducted by S.V. National Institute of Technology, Surat, India during 15–17 December 2008. The aim of the conference was to bring together experts from academic institutions, industries and research organisations and professional engineers for sharing knowledge and experience in the emerging trends related to mechanical engineering education and research. About 180 research papers were presented in 27 technical sessions of the conference encompassing a wide variety of topics under three categories:

1 thermal and fluids engineering

2 design and dynamics

3 production and industrial engineering.

This special issue of *International Journal of Design Engineering* brings out few selected papers presented during the conference under design and dynamics category with the theme *Mechanical Engineering Design and Optimisation*. These papers emphasise the new trends and innovations in modern mechanical engineering design. The first paper titled 'Mechanical engineering design optimisation using modified harmony elements algorithm' authored by Rao et al. presents a new optimisation algorithm, harmony elements algorithm (HEA), for solving mechanical engineering design optimisation problems. This algorithm is inspired by an ancient Chinese philosophy, called as theory of five elements. The efficiency and ease of application of the proposed optimisation algorithm is demonstrated by solving five different mechanical components design problems such as pressure vessel, tension/compression spring, Belleville spring, welded beam and gear train. The results of the proposed method are compared with the results given by other optimisation techniques such as genetic algorithm (GA), particle swarm optimisation (PSO), ant colony algorithm (ACA), Lagrangian multiplier approach, and branch and bound approach. In all the cases, the solutions obtained using HEA are found superior to those obtained by other optimisation techniques.

The second paper titled 'Stress intensity factors for internally loaded crack in a composite plate subjected to arbitrary biaxial loading at infinity' by Ukadgaonker and Sharma attempts to solve elastostatic problem of infinite laminated composite plate subjected to in-plane loading, with an arbitrarily oriented crack, using Muskhelishvili's complex variable formulation. The stress intensity factors are obtained by evaluating Schwarz integral, for given boundary conditions. The generalised formulation is coded using MATLAB 6.5 and numerical results are obtained for graphite/epoxy and isotropic material. The plane-stress crack models are prepared in ANSYS for some of the cases and results are compared with the existing method. The effects of crack orientation, crack length, loading pattern, fibre orientation and stacking sequence on stress intensity factors are also presented.

The third paper titled 'Non-linear thermo-elastic response of symmetric cross-ply laminated composite conical panels with temperature dependent material properties' authored by Joshi presents a study of non-linear thermo-elastic response characteristics of laminated composite conical panels with temperature dependent material properties using finite element approach based on first-order shear deformation theory and field consistency principle. The non-linear governing equations are solved using Newton-Raphson iterative technique coupled with the adaptive displacement control method to trace equilibrium path. Validation of the formulation for mechanical and thermal loading cases is carried out. Parametric study is carried out to highlight the influence of semi-cone angle, length-to-radius ratio, radius-to-thickness ratio and boundary conditions on the non-linear thermoelastic response of laminated cylindrical and conical panels.

The fourth paper titled 'Study of damping in layered and jointed welded structure' authored by Singh and Nanda presents a layered and jointed welded cantilever beam model for examining the vibration energy dissipation due to interfacial friction of jointed structures. Experiments are performed on mild steel specimens with a number of layers under different initial conditions of vibration to validate the theory developed. It is found that the interface pressure distribution characteristics, number of contacting layers, amplitude and frequency of vibration, length and thickness of specimen govern the damping capacity of jointed layered structures with welded joints. These results can be positively exploited in the design of machine tools, aircrafts, spacecrafts, satellites, automobiles and missile systems to maximise their damping capacity.

The fifth paper titled 'Vibration signature analysis of high speed unbalanced rotating shaft supported on ball bearings' authored by Upadhyay et al. presents an analysis of non-linear dynamics of a high speed unbalanced rotor supported on ball bearings. The results show the appearance of instability and chaos in the dynamic response as the speed of unbalanced shaft is varied. The appearance of the regions like periodic, sub-harmonic and chaotic behaviour is observed to be strongly sensitive to the speed of the rotating shaft. Techniques like Poincaré maps and frequency spectra are used to elucidate and to illustrate the diversity of the system behaviour.

The sixth paper titled 'Discrete optimisation of a gear train using biogeography based optimisation technique' authored by Savsani et al. presents a biogeography-based optimisation (BBO) technique for solving discrete optimisation problem of a gear train. The efficiency and ease of application of the proposed optimisation algorithm is demonstrated by solving a discrete optimisation problem of a four stage gear train from the literature. The objective considered is minimisation of weight. Eighty six inequality constraints and 22 design variables are considered in the optimisation. The results of the

proposed method are compared with the results obtained by using other optimisation methods such as GA, PSO and differential evolution (DE). The solution obtained by using BBO is found superior to those obtained by using other optimisation techniques.

The seventh paper entitled 'Effect of cone angle and length of the slot on the performance of feed slot conical air bearing' authored by Chavan and Ahuja presents the results of investigation on extremely-pressurised conical air bearings. An attempt is made by the authors to develop a new conical air bearing with feed slots which will not only overcome the problems related to orifice feeding but improve the load carrying capacity and stiffness of the bearing.

We wish to express sincere gratitude to Inderscience Publishers for permitting this special issue and all those who have contributed a great deal to the success of the conference; the authors, the reviewers, the keynote speakers, the session chairmen, the members of the organising committees and participants of the conference.

We trust the readers will find the papers published in this special issue more useful in their future endeavours and research work.