ABSTRACT

Nowadays, vibration is one of the major issues in the environment, which may cause some serious injuries to the human health. The human response to vibration can be both mechanical and psychological in nature. Mechanical injury to human tissue can occur due to the resonance within different organ systems. Psychological stress reactions also happen from vibrations. Due to this reasons vibration needs to be eradicated with proper controlling techniques. The vibration control is a large area of interest for all sections of industry and research work. Nowadays smart materials are widely used for vibration control. Shape memory Alloy is one of the smart materials which exhibit the ability to induce large mechanical strains upon heating and cooling. Therefore Shape memory alloy (SMA) elements have been considered for control of vibrations as well as for the enhancement of stability of flexible engineering structure. To analyze the effect of shape memory alloy in controlling the structural vibrations closed coil Nitinol tension springs were procured from Dyna Alloy, U.S.A. The performance of SMA springs was evaluated experimentally and numerically. A cantilever beam was used as basic representative model of advanced flexible engineering structure. The shape memory alloy springs were attached in various combinations as in parallel and series at free end and 450 mm from fixed end of cantilever beam and effectiveness in vibration control was verified. According to experimental set up, modeling has been done in ANSYS workbench R15.0 and harmonic response analysis was carried out. The numerical results were validated with experimental results. On the basis of experimental results of stiffness of SMA spring, mathematical modeling was done for second order curve in MATLAB software. After execution of programs, it is observed that mathematical model of second order curve is closely mapping with experimental results. On the basis of experimental and numerical results, various graphs have been plotted showing reduction in amplitude of cantilever beam over range of frequencies and effective role of SMA in vibration control. Positively it will be helpful to the designer and practitioners who are working in the field of mechanical and structural vibration.