

ABSTRACT

In the present work an attempt has been made to study the feasibility of using EG composite as an alternate material for the bed structure of CNC lathe. The main objective of the research work is to establish the material properties, design, analyse and develop an epoxy granite bed to enhance the static and dynamic behaviour of CNC lathe for improved performance in terms of chatter free machining, improved surface finish and geometric accuracy.

Characterization studies were carried out to determine the strength, damping, water absorption and thermal properties of EG composite by considering variables such as aggregate mass fraction, aggregate size mix, stirring speed for mixing of epoxy and granite, post curing temperature and time. The study revealed that EG offers better damping, water absorption and thermal properties than cast iron. To investigate the feasibility of using EG in machine tools, CNC lathe bed is considered for the study. Initially, the static and dynamic behaviour of existing lathe bed made of CI is investigated to establish the benchmark characteristics. Five different configurations of EG bed were designed considering the static stiffness requirements of CI bed, minimum wall thickness, manufacturing and assembly constraints. There was a significant improvement in the stiffness of the proposed EG bed as compared with that of CI bed.

A positive shift in natural frequencies of the proposed EG bed was realized, and this will help to improve the dynamic stability of CNC lathe. The improvement in natural frequencies and damping ratio can be attributed to higher inherent material damping properties of EG composite. The foregoing discussions lead to the conclusion that the epoxy granite composite developed in this work can be considered as one of the most suitable alternatives for structural materials in machine tools owing to improved dynamic characteristics along with lesser weight compared to cast iron structures.