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Abstract. The demand of composite materials is on the rise due to the stringent requirements in various industries. In the design of composite structures, the mechanical properties play a crucial role in determining the structural integrity and safety. This paper presents an analysis of the effects of impregnation time and pressure on the physical and tensile properties of sugar palm fibres. The study also investigates the influence of yttrium-rich intermetallic phases and heat treatment on the microstructure, hardness, and wear properties of an aluminium-15% Mg$_2$Si composite. The vibration analysis of thick arbitrarily laminated plates under various shapes and edge conditions is also discussed. The results highlight the importance of optimising these parameters to achieve enhanced performance and durability in composite materials.

Introduction

Traditionally, the design of composite materials involved a trial-and-error approach. However, with the advancement in computational tools and software, the design process has become more systematic and efficient. The mechanical properties of composite materials are complex and depend on various factors such as the fibre volume fraction, matrix type, and processing conditions. An accurate prediction of these properties is crucial for the successful design and manufacture of composite structures.

Evolution of Mechanical Properties

In the 20th century, the understanding of mechanical behaviour of composite materials was limited. Advances in material science and the development of numerical modelling techniques have significantly improved the ability to predict and control the properties of composite materials. These advancements have enabled designers to optimise the design process for enhanced performance and reduced cost.