



# Study of Mechanical Properties of Foam-Filled Sandwich Composite

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**Abstract.** The process of optimizing the weight of joints in sandwich structures with a honeycomb core is currently in its initial stages. To enhance the physical and mechanical properties of specific zones within the honeycomb structures, the honeycomb core is reinforced by modifying its geometric parameters or by filling the cells with a hardening material. This introduces further complexity in achieving a practical solution for minimizing the weight of these intricate structures. We have developed analytical expressions for the reinforced honeycomb core with filling material, enabling us to determine its effective physical and mechanical characteristics. For this purpose, the stiffness of elements within the resulting composition was evenly distributed across the representative cross section of the element. Subsequently, the discrete element model of the honeycomb core with the filling material was further developed. The performance of the honeycomb core with the filling material was anticipated, taking into consideration the specific load accommodation by individual honeycomb cell elements. To validate our findings, finite element modeling was employed. The study focused on a 15 mm high honeycomb core made of aluminum foil with a regular hexagonal shape for the honeycomb cells. Various filling materials with elastic moduli ranging from 720 to 7200 MPa were examined. Our results may serve as a valuable addition to the established methods for analyzing sandwich structures, thereby enhancing the overall reliability of the outcomes.

**Keywords:** Honeycomb core · Reinforcement · Elastic base

## 1 Introduction

Sandwich structures made of polymer composite materials (PCM) are widely utilized across various industries due to their exceptional properties [1, 2]. Honeycomb core-based sandwich structures find extensive applications in the aviation, space, automotive, railway, and shipbuilding sectors [3, 4]. The honeycomb structures are composed of