



University of Zabol

Graduate school

Faculty of Natural resources

Department of Wood and Paper Science and Technology

The Thesis Submitted for the Degree of Master of Science  
(In the Wood Composite Products)

**Investigating the possibility of using glass fiber composite rebars as dowel  
in mitered joint of furniture frames**

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## **Abstract:**

The structure of furniture is composed of various components, which are connected using different methods and fasteners to form an engineering structure. The connection method, type of fastener, and quality of the connection play a significant role in the bending moment capacity of the furniture frame joints. One of the most important and commonly used connections in the construction of furniture frames is the miter joint, which is executed with various fasteners such as biscuits, dowels, cleats, and dovetails. These types of frame connections are typically subjected to tensile, compressive, or both types of loads. Therefore, assessing the bending moment capacity of the joints in furniture frames and studying the impact of the type of fastener is crucial. In this study, the connecting members were made from MDF sheets and particleboard with dimensions of 20 x 7 cm and a thickness of 16 mm, then mitered at a 45-degree angle and prepared for connection using wooden and composite dowels. Glass fiber-reinforced polymer (GFRP) rods (epoxy matrix with glass fibers) with diameters of 6, 8, and 10 mm were sourced from the Apourad Khuzestan factory and used as dowels in the miter joints of the furniture frames. In addition to different sizes of GFRP dowels, other variable factors such as the number of dowels used (one and two), type of adhesive (PVAc and epoxy), diameter of the wooden dowels (6, 8, and 10 mm), and the material of the connecting members (particleboard and MDF) were examined. After testing the samples with a Hounsfield model 0308 device, the test data were analyzed using SPSS software, and Duncan's test was employed to compare the means. This investigation demonstrated a significant impact of using glass fiber composite dowels compared to beech wooden dowels in enhancing the strength of the furniture frame connections under diagonal tensile loads. Specifically, changing the dowel material from beech wood to glass fiber composite increased the bending moment capacity under diagonal tensile load by 50% for particleboard and 71% for MDF. Additionally, the bending moment capacity of the corner joint under tensile load increased with the dowel diameter, with increases of 38% and 19% for particleboard and 19% and 8% for MDF, respectively, when the diameter increased from 6 to 8 mm and from 8 to 10 mm. The type of adhesive also influenced the strength of the joints; changing the adhesive from polyvinyl acetate to epoxy resulted in increases of 14% and 47% in bending moment capacity for joints made with MDF and particleboard, respectively. Joints made with epoxy adhesive showed better bonding quality and higher resistance compared to those made with polyvinyl acetate. The bending moment capacity of the corner joint also changed with the number of dowels; increasing the number from one to two resulted in increases of 44% and 9% for joints made with particleboard and MDF, respectively.