

## **Abstract**

Polygonal shafts are a major competitor to spline and keyed shafts for power transmission due to features as self-centering, lack of stress concentration area, and ease of assembly and disassembly. Past studies on polygonal profiles have focused on a single profile and comparisons based on nominal sizes of three and four lobe profiles. This research explores the loading strength of the standardized three and four lobe polygonal shafts and hubs manufactured from the same stock size, subjected to pure torsional and torsional bending load from a spur gear of  $20^\circ$  pressure angle at various fits. In absence of analytical solution, Finite element method has been used after verifying the results experimentally, theoretically, and DIN standard. From the finite element analysis, the hub was found to experience greater stress than the shaft in all cases. The clearance fit was found to be the most critical connection and interference fit to be the most suitable for larger power transmission. The P4C connection had greater stress, especially in the hub, than the P3G connection. The difference between the P4C shaft and the P3G shaft was 4.05% in the interference fit and 60.6% in the clearance fit, suggesting P4C clearance fit to be less favorable for larger power transmission. Owing to its small normal axial stress, the P4C clearance fit has its use in low power transmission where sliding fit is a requirement. The reason for greater stress in P4C shaft and hub connection is due to the large pressure angle at the point of contact, which leads to a smaller contact area and greater contact pressure. The contact pressure was found to be triangular shaped in clearance and transition fit and with a large crest, followed by a trough and a small crest in interference fit for torsional bending load.