

Design and Analysis of lightweight Polyetheretherketone (PEEK) Front Lower Control Arm

F.T.Pawi¹, Rosdi Daud^{1*}, H. Mas Ayu¹, Tedi Kurniawan¹, S.H. Tomadi¹, M.S. Salwani¹, A.Shah²

¹Faculty of Mechanical Engineering, Universiti Malaysia Pahang,
26600 Pekan, Pahang, Malaysia,

²Faculty of Technical and Vocational, Universiti Pendidikan Sultan Idris,
35900 Tanjung Malim, Perak, Malaysia

*Email: rosdidaud@ump.edu.my

ABSTRACT

Forged Aluminum is regarded as the optimum process for producing light weight front lower control arm (FLCA) with assured internal qualities and high reliabilities since aluminum forging provides the highest weight reduction effect, as much as 35 to 40% reduction compared to cast iron. However due to the high cost of aluminum and motivation to reduce carbon dioxide emissions, the aim of this research is to develop lightweight material with optimum design of FLCA and achieve equivalent structural performance and function at a reduced cost relative to the baseline forged aluminum FLCA. In this research, the first stage was started with reverse engineering (RE) of forged aluminum FLCA, which RE refers to the process of obtaining a CAD model from an existing physical part. CAD model is prepared using solidwork software and finite element analysis by using Autodesk mechanical simulation software. We constructed a 3D CAD model for both baseline forged aluminum front lower control arm (FLCA) and improved design of FLCA using Solidwork (optimum design). The models are subjected to loading and boundary conditions and then analyzed using the FEA techniques which the optimum design FLCA used the lightweight polymer, polyetheretherketone (PEEK). The structural analysis was conducted to find out the stress, deformation and safety factor of PEEK FLCA. The structural analysis result of PEEK FLCA showed that the standard load given was not exceeded the yield strength of PEEK material, 100Mpa. The safety factor for the optimum design of PEEK FLCA, 1.09 is also bigger than 1. Thus, it showed that it is safe to use lightweight plastic, PEEK as a FLCA to replace forged aluminum and proof that the research aim to develop lighter weight than aluminum is achieved.

Keywords: front lower control arm; reverse engineering; polyetheretherketone; finite element analysis; optimum design.