STRUCTURAL ANALYSIS OF FIXED-GEAR BICYCLE FRAME BY USING FINITE ELEMENT METHOD

Abstract

In bicycle design, strength of a frame must absolutely be considered due to user’s safety. Failure which occurs on a frame will directly affect the rider.

This research is conducted by investigating stress distribution and deformed shape contours which occur due to the load, using a finite element method. The load, which come from the rider mass, is measured according to normal riding position. The research studies the effect of modification of fixed-gear (fixie) bicycle frame geometry.

The results of the analysis indicate that the top tube bar and seat stays are influencing stress distribution and deformed shape contours. The larger the distance between the joint which connects top tube and seat tube and the joint which connects seat stays and seat tube, the larger the stress response is and the larger the variation of the stress in each of the area of interest. All models of the frame (normal and modified) are safe under the given loads. The best frame models are normal frame and the so-called modification-5 model, which indicate relatively smaller and even distributed stresses. The modification-5 model is a frame that has seat stays lower than a normal frame and a top tube bar with position steeper than horizontal (a different of approximately 16°).

Keywords: bicycle frame, fixed-gear bicycle, finite element method, shell element.